DOCUMENT RESUME

ED 171 533 SE 027 595

AUTHOR Bielefeld, Carole
TITLE SI - A Metric Workbook for Teachers of Consumer & Homemaking Education.
INSTITUTION Orange County Dept. of Education, Santa Ana, Calif.
PUB DATE 77
NOTE 117p.; Not available in hard copy due to copyright restrictions
AVAILABLE FROM Orange County Department of Education, 1300 South Grand Avenue, Building B, P.O. Box 11846, Santa Ana, California 92711 ($1.50)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS *Consumer Education; *Curriculum Guides; *Homemaking Education; Instruction; Learning Activities; *Measurement; *Metric System; Secondary Education; *Secondary School Mathematics

ABSTRACT

This workbook is presented in a format designed for easy use by instructors of consumer and homemaking education. The material is geared for the daily activities of the American home. An introduction contains a history of the metric system and a discussion of the future role of the metric system in the United States. Detailed instructions are given for a transparency presentation of the metric system, including the narration. A series of experiments is described to provide for learning activities. Reference materials include additional classroom activities, conversion charts, and sources of metric supplies. (MP)

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PUBLICATION DATE: 127340	DECEMBER	1973
	MARCH	1974
	JULY	1974
	OCTOBER	1974
	APRIL	1975
	SEPTEMBER	1975
	JANUARY	1976
	AUGUST	1976
	MARCH	1977

PRICE . . . . . $1.50 Prepaid

TO PLACE AN ORDER WRITE:
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ACKNOWLEDGEMENTS

"S.I. . . . A METRIC WORKBOOK FOR TEACHERS OF CONSUMER AND HOMEMAKING EDUCATION"

. . . has been compiled for you by Carole Bielefeld, Director of Vocational Education, Orange County Department of Education;

. . . with input on classroom activities by Kathleen Morris Randall, instructor at California State University at Long Beach;

. . . with input on the "round robin" activities by Jan Parks, instructor at Santa Ana College, Family and Consumer Studies Department;

. . . with advice and assistance from Lorelle Young, instructor at West High School, Torrance Unified School District, Torrance, who has initiated much of the metric involvement by the California Home Economics Association;

. . . and, was inspired by the Metric Conference at University of California at Los Angeles held on September 7-8, 1973.

NOTES

The material contained within this workbook is geared for the daily activities of the American home. It is not intended for use by mathematicians or scientists who would be seeking metric information in greater depth.

The workbook is presented in a format which should be easy to use by instructors of Consumer and Homemaking Education. It is expected that the home economist will play a vital role in the distribution of metric information to the consumer.

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PART I: INTRODUCTION

A. A HISTORY OF THE METRIC SYSTEM

B. IS THE U. S. GOING METRIC?

C. ARE YOU READY FOR METRICS? (PRE-TEST)

A. A HISTORY OF THE METRIC SYSTEM

The metric system originated in France where it was adopted by the National Assembly on April 7, 1795. Most nations in Europe, Central and South America adopted it for commercial use during the middle and last half of the 19th Century. Following World War II, the Soviet Union and China made the use of metric units mandatory. India and Japan followed in the 1950's. Britain began a ten-year conversion to the metric system in 1965. South Africa will have completed the metric conversion by 1975. In 1969 New Zealand began an eight-year conversion to metric units, and in 1970 Australia and Canada announced their commitment to metricate.

In the United States. Use of the metric system in the United States was made legal but not mandatory by an Act of Congress in 1866. Since that time, all U. S. customary units of measurement have been based upon metric standards.

Several bills which would have made the use of the metric system mandatory failed in Congress by very small margins during the first 30 years of this century.

In 1968 the Miller-Pell Metric Study Bill was passed. It authorized the Secretary of Commerce to conduct a program of investigation, research and survey to determine the impact on this country of the increasing worldwide use of metric units and to determine what action should be taken in the United States as a consequence.

On July 30, 1971, the results of the study were presented to the U.S. Congress in a report titled A Metric America--A Decision Whose Time Has Come. In releasing the report, Secretary of Commerce

Maurice H. Stan said, "For many years, this Nation has been slowly 'going metric', and it would continue to do so regardless of national plans and policies. At the same time, the worldwide use of the metric system is increasing, and today ours is the only major nation which has not decided to take such a step. As the Report states, a metric America would seem to be desirable in terms of our stake in world trade, the development of international standards, relations with our neighbors and other countries, and national security." He also emphasized that early priority be given to educating every American school child and the public at large to think in metric terms.*

Dr. Wilson Riles, Superintendent of Public Instruction of the State of California, announced his personal commitment in 1973 for a changeover to metric instruction in the schools. The reasons for this commitment were threefold: (1) metrication is inevitable in the United States, (2) the metric system is much more efficient than the customary system that we now use, and (3) students will find it is easier to learn.

Dr. Riles stated that "the schools must lead--and not lag--in the movement toward metrication. The process of conversion is much smoother and much less costly when education changes over early. In England, the schools got off to a slow start in metrics instruction; that country's transition encountered many problems and much confusion as a result. By contrast, Australia's schools were in the forefront of the conversion to

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*REFERENCES:

Metric Units of Measure, 10th edition, Metric Association, Inc., 2004 Ash Street, Waukegan, Illinois 60085, 1972.

metrics; the result is a much more orderly and successful transition in that country."

Further, he stated, "I believe that California should take the lead toward metrication in America. I believe that the schools should be in the forefront of the metrication movement. That is why I made these recommendations to the State Board of Education in the spring [1973]: First, endorsement of pending legislation to provide funds to train teams of teacher-trainers in metrics. Second, action by the State Curriculum and Supplemental Materials Commission to plan for metrics textbooks by 1976. Third, support for colleges and universities to move to metrics in the training and education of new teachers.

"There is another area of effort I have also emphasized. I am not worried about the ability of children to learn metrics with ease. But those of us who are older--parents and citizens--will face a tougher adjustment. Our adult education system and the communications media will have to be involved in the effort to help the public learn to 'think metric.'

"The Department of Education is working to develop plans for such training through its existing staff and resources. We will also pursue other related projects. Vocational education and *home economics* (italics provided by editor) classes, in particular, will need special help which we will provide."*

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*REFERENCES:

Speech given at UCLA at the Metric Conference, September 7, 1973.

B. IS THE U.S. GOING METRIC?

Most persons would probably be shocked to hear the U. S. described as a backward country. But that seems the most appropriate word to describe this country's cumbersome system of weights and measures. This measurement hodgepodge, called the customary or English system, is about to change.*

There are well defined advantages and disadvantages to the metric conversion. Specific advantages that industry could realize by adopting to the metric system are as follows:

1. Metric is a Universal System. World trade is constantly growing. A changeover to the metric system could stimulate sales and help balance exports against imports.
2. The Metric System is Easier to Use. The measuring units are interrelated and are also in multiples of 10 or divisible by 10.
3. Calculations are Faster. The system is particularly adaptable to computers and calculators.
4. Less Chance of Error. Decimals replace fractions which in the conventional system make calculations slower and increase chance of error.
5. Interchangeability of Machine Parts. Adoption of the metric system could lead to universal standards for machine parts, permitting them to be used on machines of different makes.
6. Standardization of Tools and Gauges. Universal acceptance of tools would reduce the number of each that would be needed by industry and individual workers.

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*REFERENCES:

Joyce Patterson, "Think Metric to Meet the Challenge," Co-ed, September, 1972.

7. Especially Useful in the Laboratory. Tests and laboratory instruments are easily calibrated and simpler to read.

8. Eliminate Double Measuring System. Factories in both the U. S. and foreign countries must produce equipment for both metric and customary measurements. This double standard creates confusion and a greater cost.*

In the conversion to the metric system, the greatest disadvantage for Americans would be in acceptance of the changeover--not in learning the system itself. There is also a concern as to the ultimate cost.

1. Reluctance to Change. Resistance to change is a natural human response. Educators and industry have a vital role to play in assisting the American population to more easily accept the change-over to the metric system of measurement.

2. Expense. The change to metric units by industry takes money. But, with careful planning, much of it can be phased into the normal costs of replacement of equipment and machinery.

Will the U.S. go metric? It has been going metric! Many large American corporations are already converting to the metric system: IBM, Honeywell, General Motors, Regal-Beloit, ITT, General Mills, as well as many others. The 1974 Ford Pinto and Mustang have metric engines. The 1976 Chevette is claimed to be the first U. S. built all metric car. (See reference section for details.) We have long been measuring film metrically: 35 mm film, 16 mm film, and the 8 mm film (Super 8).

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*REFERENCES:

Wilmer Westbrook, "The Metric System," Modern Textiles, August, 1970.

In restaurants we order the house wine by the litre or half-litre flask. Sports enthusiasts should now be very aware of the 100 metre track race or the 50 metre swimming pool. We often read in the newspaper about narcotics officers confiscating a "kilo" (meaning kilogram) of marijuana. The pharmaceutical industry has used the metric system for years. Many hospitals have converted to metric units for patient statistics and dispensing of drugs. All distances and elevations in the firing of weapons by the U. S. Army are now measured in metres as is basic triangulation by the U. S. Coast and Geodetic Survey.

Metric Conversion Act of 1975*

The Metric Conversion Act of 1975 which President Gerald Ford signed on 23 December 1975 became Public Law 94-168. It is a 6-page document which has the following introduction:

"To declare a national policy of coordinating the increasing use of the metric system in the United States, and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system."

Principal provisions of the Act call for establishment of a 17-member Board of qualified persons. The chairman and 16 other members will be appointed by the President with the advice and consent of the Senate. Twelve of these will be from specific sectors of society and four at-large members will represent consumers and other interests deemed suitable by the President.

Once the Board is functioning it shall appoint a full-time executive director who will be responsible to the Board and shall carry out the metric

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*REFERENCES:

"U. S. Metric Association Newsletter," Vol. 11, No. 1, February, 1976.

conversion program, pursuant to the provisions of the Act and the policies established by the Board.

The Board will have no compulsory powers but will carry out a broad program of planning, coordinating, and public education consistent with other national policy and interests, with the aim of implementing the policy set forth in the Act.

(Complete text of PL 94-168 begins on page 71.)

C. ARE YOU READY FOR METRICS? (PRE-TEST)

Please fill in the correct answers:

1. 1 ounce = _____ tablespoon(s)
2. 4 ounces = _____ gill(s)
3. 16 tablespoons = _____ cup(s)
4. 32 ounces = _____ quart(s)
5. 105 quarts = _____ barrel(s)
6. 1 cord = _____ cubic foot/feet
7. 4 pecks = _____ bushel(s)
8. 1 bushel = _____ quart(s)
9. 1 peck = _____ quart(s)
10. 1 ton = _____ pound(s)
11. 16 ounces = _____ pound(s)
12. 1 dram = _____ grain(s)
13. 12 inches = _____ foot/feet
14. 1 rod = _____ foot/feet
15. _____ feet = 1 mile
16. _____ yards = 1 mile
17. _____ rods = 1 mile
18. _____ cubic foot/feet = 1 cubic yard

Correct your answers to the Pre-test:

1. 2 tablespoons
2. 1 gill
3. 1 cup
4. 1 quart
5. 1 barrel
6. 128 cubic feet
7. 1 bushel
8. 32 quarts
9. 8 quarts
10. 2000 pounds
11. 1 pound
12. 24 grains
13. 1 foot
14. 16 1/2 feet
15. 5280 feet
16. 1760 yards
17. 320 rods
18. 27 cubic feet

Scoring:

18 - 16 correct:	CONGRATULATIONS! You really know the customary system, but you'd better get ready for the metric system anyway. It's coming!
15 - 11 correct:	PRETTY GOOD! It may be difficult to adjust, but you have only about one-half of what you already know to forget!
10 - 0 correct:	LUCKY YOU! You have almost nothing to unlearn. You'll love the metric system!

PRE-TEST: Developed by Kathleen Morris Randall of California State University, Long Beach.

PART II: LEARNING THE METRIC SYSTEM OF MEASUREMENT

. . . A TRANSPARENCY PRESENTATION WITH NARRATION

INSTRUCTIONS TO TEACHER: PREVIEW

- Before showing the transparencies, preview the visual aids as to:

  litre

  metre

  gram

  degree Celsius

  Note: Directions for developing these materials are found in Part IV (pages 47 to 50).

- Show division of metre into 100 sections known as "centimetres."

- Show chart or distribute individual handouts with information as to "Some Common Units" and "Metric Usage."

  Note: These appear in Part IV (pages 45 and 46).

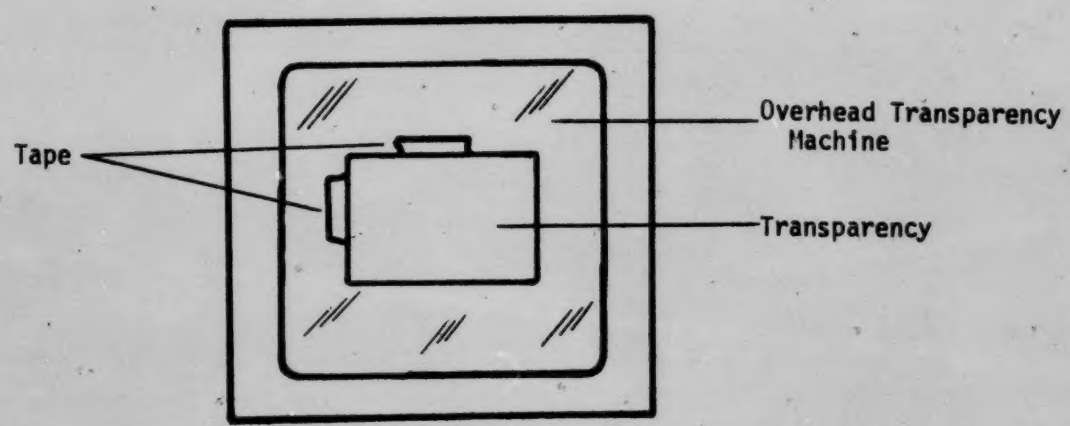
INSTRUCTIONS TO TEACHER: MAKING THE TRANSPARENCIES

- Remove pages from workbook of the transparency masters (located after page 25 of this workbook).

- Make the transparencies (find out the instructions for making transparencies from your local audio visual expert).

- Cut each sheet in half to provide separate half-sheet transparencies.

- Lay the first transparency on the projector and check the placement for best viewing. Frame this transparency with masking tape on the glass. This procedure will provide a guide for consistent transparency placement.

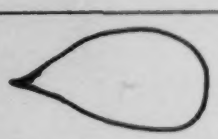


LEARNING THE METRIC SYSTEM OF MEASUREMENT

Transparency Miniature	Narration	
SI...Système International or International System of Measurements	SI is the official system of metric measurement that will be used by the United States. The "Système International de'Unites" or International System of Units was officially adopted in France in 1795.	1
(world map)	The United States is the last large country in the world to commit itself to convert to the metric system of measurement.	2
(Ford Pinto)	The United States has long been going metric. Many industries have already converted. The 1974 Ford Mustang and Pinto engines were metrically scaled. The 1976 Chevette is totally metric. (See page 57 for specifications.)	3
(film)	Film has long been measured metrically: 35 millimetre film, 16 millimetre film, and 8 millimetre film (Super 8).	4
(restaurant/wine)	We often order house wine in a restaurant by the litre or half litre. (See Glossary regarding spelling.)	5
(runner)	Sports enthusiasts should now be very aware of the 100, 200 or 400 metre track race.	6
(swimmer)	Or, the 100 metre swim event.	7

	Transparency Miniature	Narration
8	(newspaper article)	We often read in the newspaper about the narcotics officers confiscating a "kilo" (meaning kilogram) of marijuana.
9	(pills and containers)	The pharmaceutical industry has used the metric system for years.
10	(glass of milk with nutritional value listed)	...and dietitians and home economists have been measuring in the metric system the food value and adequacy of daily diets. Every morning you can read the listing of nutrients in grams and milligrams on the back of your cereal box!
11	(metric bill)	In December of 1975, President Ford signed the Metric Conversion Act of 1975. The law declares a national policy of coordinating the increasing use of the metric system in the United States and to establish a U. S. Metric Board to coordinate the voluntary conversion to the metric system.
12		The consumer will be the effected group offering the most resistance to metrics as direct benefits are difficult to assess. The program presented here is designed to provide positive feelings toward metrics for the consumer.
13	Now, let's get ready to... GO METRIC!	Now, put on your thinking hats . . . and let's get ready to GO METRIC!
14	Qty Unit Symbol METRE LITRE GRAM DEGREE CELSIUS	The consumer will only have to become familiar with four of the basic units. The metre, litre, gram and degree Celsius. Study this for a moment. (Hold and review with students.)

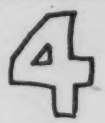
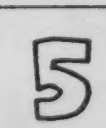
Transparency Miniature	Narration	
Qty Unit Symbol ? ? ? ?	How well do you already know the four basic units? Test yourself. Can you fill in the blanks?	15
Qty Unit Symbol METRE LITRE GRAM DEGREE CELSIUS	Did you know all the answers? Check yourself.	16
Qty Unit Symbol etc. etc. etc.	A mathematician or scientist would need to know a few more metric units. The consumer, however, would rarely use these. (Study this for a moment.)	17
deci- centi- etc. milli-	To more fully understand the metric system we also need to learn some prefixes. Here are the most common prefixes that are added on to the basic units to make them smaller or divide them into portions. (Hold and study with class.)	18
kilo- mega-	Here are the most common prefixes that are added on to the basic units to make them larger, or to multiply them into larger portions. (Hold and study with class.)	19
Unit Prefix etc.	Here is the total metric language for the consumer's use. (Hold and study.) ...now let's look at one unit at a time.	20
 THE METRE (metre stick next to yard stick)	The metre is slightly larger than a yard. (The metre actually is 39.4 inches long.)	21

	Transparency Miniature	Narration
22	metre replaces 	The metre will replace conventional measures for length. These are: inch, foot, yard, mile, fathom, rod, cubit, furlongs, span, nautical mile, hand, palm, etc.
23	metre X 1 000 = 1 kilometre (speed sign) (km)	The metre X 1 000 is called a kilometre. (See Glossary for pronunciation.)
24	(metre divided into parts)	1/10 of a metre is called a decimetre. 1/100 of a metre is a centimetre. 1/1 000 of a metre is a millimetre. (Hold and review with class.)
25	(finger)	As a point of reference, note that the width of your fingernail is approximately one centimetre.
26	(hand span)	Note, also, the approximate span of your hand from the end of your thumb to the end of the little finger is approximately 20 centimetres.
27	0.1 metre 1.0 decimetres 10.0 centimetres 100.0 millimetres	We can easily do our math problems by moving a decimal point back and forth. (Hold and review.)
28	Problem: 0.4 metre 4 decimetres ? centimetres ? millimetres	Can you answer this problem? (Answers are 40 cm and 400 mm.)

Transparency Miniature	Narration	
Answers to the problem: 0.4 m 4 dm 40 cm 400 mm	Here are the answers.	29
1/4 yard = 3/4 foot = 9 inches	Remember when we easily converted 1/4 yard to equal 3/4 foot to equal 9 inches? Or... did we ever bother?	30
(girl with 36-inch bustline)	Conventionally, we referred to body measurements by the inches. Did we ever say, "She has a yard bustline"? Or, did we say, "She has a 3-foot bustline"?	31
(girl with ?? bustline)	In the metric systen, the centimetre would be the most common unit used in body measurements.	32
metre x 1 000 = ? 1/10 metre = ? 1/100 metre = ? 1/1 000 metre = ?	Let's review the metre. (Hold and read through chart.)	33
= kilometre = decimetre = centimetre = millimetre	Here are the common metre measures. (Hold and read through chart.)	34
2 THE LITRE (litre next to a quart)	Our second unit of measure will seem easier. Let's look at the litre. The litre is slightly more than a quart. (Just enough to provide a saucer of milk for kitty -- 1/4 cup.)	35

	Transparency Miniature	Narration
36	litre replaces	The litre will replace the quart, gallon, fluid ounces, bushel, peck, gill, barrel, etc.
37	(measuring utensil)	While we are converting to the metric system, the household measuring utensil may look something like this.
38	(litre divided into sections)	The litre will be divided into 1 000 parts called millilitres.
39	(litre container)	The litre could be divided into 10 parts and called decilitres and 100 parts and called centilitres.
40	(litre container)	These units will be very uncommon however. The terms to remember when measuring volume are LITRE and MILLILITRE.
41	3 GRAM ...for mass (weight)	Our third unit of measure will be the gram. This is used for mass -- or weight. (See Glossary re: gram)
42	gram	The gram replaces the ounce, pound, ton, grain and dram.

Transparency Miniature	Narration	
1 000 grams = 1 kilogram	The gram is rather small, so we generally refer to the kilogram (1 000 grams).	43
(one pound of butter and one kilogram of butter)	One kilogram weights slightly more than two pounds. (Actually 2.2 pounds)	44
(lady on scale smiling)	Hey, this is great! I only weigh 80 kilograms!	45
80 kg? 80 kg? ??? hint: 1 kg = 2.2 pounds	Wait a minute! If a kilogram is slightly more than double a pound, about how much does this lady weigh in pounds?	46
(lady on scale frowning) 176 pounds	Quick guessing would give us 160+ pounds. In actuality, she would weigh 176 pounds.	47
We metrically measure...	Let's review what we have learned so far. Fill in the blanks.	48
We metrically measure...	How did you do? (Hold and review with class.)	49

	Transparency Miniature	Narration
50	(picture of related metre, litre and gram)	The three units that we have just learned (metre, litre and gram) are all related to each other in a very special way. 1 cubic centimetre = 1 millilitre and when filled with water weighs 1 gram.
51	(larger portions related)	Or, 1 cubic decimetre = 1 litre and when filled with water = 1 kilogram. (If possible, the teacher can stop here and demonstrate this fact with a clear plastic decimetre cube.)
52	 (thermometer)	The fourth metric unit that we will learn is the degree Celsius for temperature.
53	(2 thermometers: one Celsius, one Fahrenheit)	You may formerly have known this as the Centigrade temperature. Freezing is 0 degrees and boiling is 100 degrees. The Celsius thermometer is divided into 100 degrees from 0 to 100. This is much easier to remember than 32 degrees Fahrenheit for freezing and 212 degrees Fahrenheit for boiling!
54	(child with thermometer)	Normal body temperature is 37 degrees Celsius! (Remember 98.6 Fahrenheit?) A concern of the consumer should be that a fever of one degree Celsius would be much more serious than a fever of one degree Fahrenheit!
55	(thermometer with labeled temperatures)	We will just have to become familiar with the different temperatures. For example, our normal body temperature is 37 degrees Celsius; a comfortable room temperature would be 20 degrees Celsius; and a warm, sunny beach day might be 25 degrees Celsius.
56	 JOULE	One additional metric unit of measure with which the consumer should be familiar is the joule. (Pronounced as "jewel") (See Glossary)

Transparency Miniature	Narration	
A diet with a Caloric value of 2,000 is approx equal to a diet with an energy value of 8 000 kilojoules. Ratio: 1:4 approx Ratio: 1:4.2 actuality	The joule in the International System of Units would replace the Calorie. (Hold and review with class.)	57
(picture of fat person stuffing self with R_x note for 4 000 kilojoule diet.)	When dieting, don't get carried away when told to use a 4 000 kilojoule diet! This is the same as a 1,000 Calorie diet.	58
Basic Units Prefixes Rules	We now know the basic units of the metric system and the prefixes. Now we must learn some rules in writing metrics.	59
NO: ~~14 cm.~~ YES: 14 cm	First of all, use no periods after the symbols and always leave a space between the number and the metric symbol.	60
NO: ~~14 cms~~ YES: 14 cm	When writing plural measurements, never use an "s" after the symbol. The number itself indicates that it is plural.	61
NO: ~~14 CM~~ YES: 14 cm HOWEVER YES TO: C for Celsius	The symbols should be in lowercase except for those designated. (See Glossary)	62
NO: ~~14,000 km~~ YES: 14 000 km	Commas should be omitted in figures representing large amounts as the comma in some countries is interpreted as a decimal point. Instead, we are encouraged to leave a space.	63

	Transparency Miniature	Narration
64	(speed sign 90 km/hour)	How will all this affect us? Can you imagine going 90 km/hour on the free-way?
65	(gas 16¢/litre)	Can you imagine paying only 16¢ a litre for gas? Yes, you will quickly adapt to this when you find that your 16 gallon tank now holds over 60 litres!
66	(bright, sunny day--person looking through window with ????)	Can you imagine the weatherman saying, "Enjoy your sunny, warm 25 degree weather tomorrow"?
67	(sick person)	Can you imagine the doctor saying, "You have a temperature of 39 degrees Celsius! You're really sick."
68	(fabric and zipper)	Can you imagine buying 2 metres of fabric and a 20 centimetre zipper for your new dress?
69	(picture of girl)	Can you imagine having slim body measurements of 87-65-92?
70	(picture of boy and girl)	Can you imagine weighing only 50 kilograms?

Transparency Miniature	Narration	
(baby announcement)	Can you imagine receiving a birth announcement reading: New Baby Boy Weight: 3.1 kilograms Length: 49 centimetres	71
HAPPY METRICATION! Transparencies and script presented by Orange County Department of Education.	HAPPY METRICATION!	72

1

SI

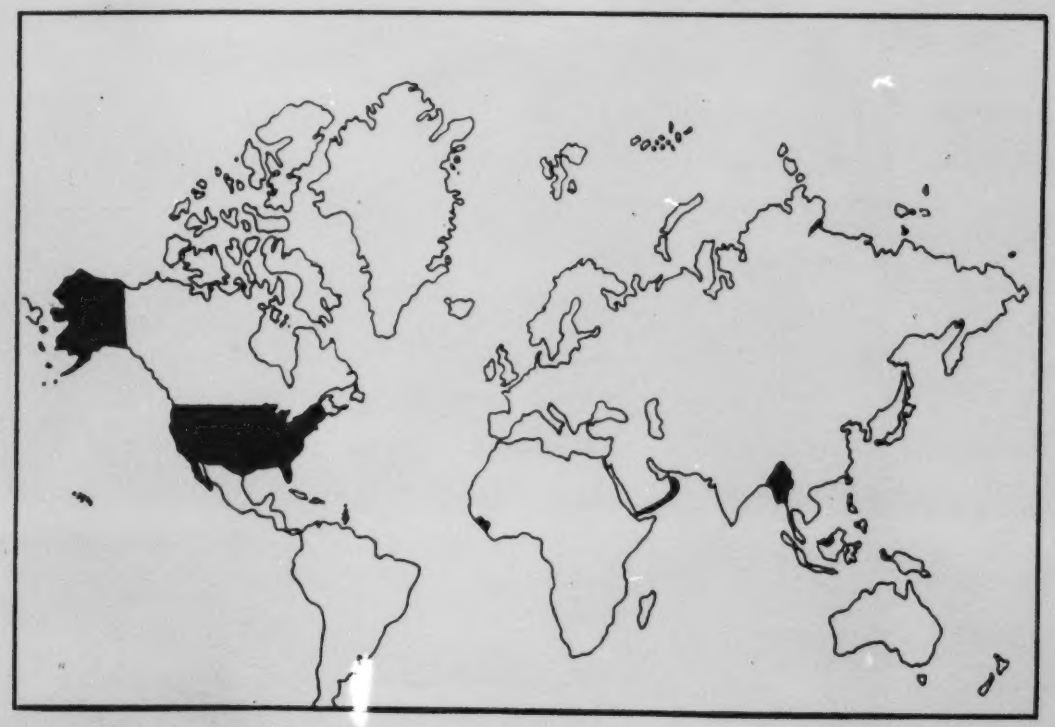
SYSTÈME INTERNATIONAL

Système International d'Unités, or

International System of Units

2

ISLANDS IN A METRIC WORLD



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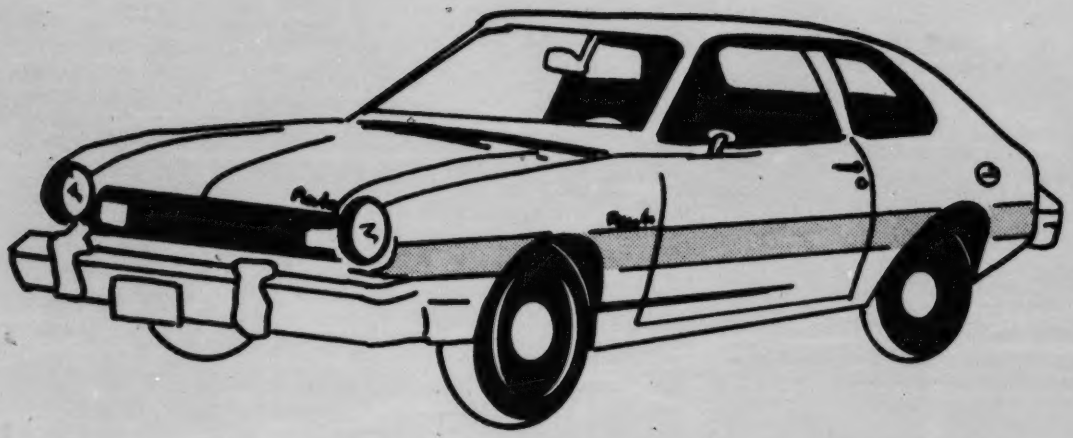

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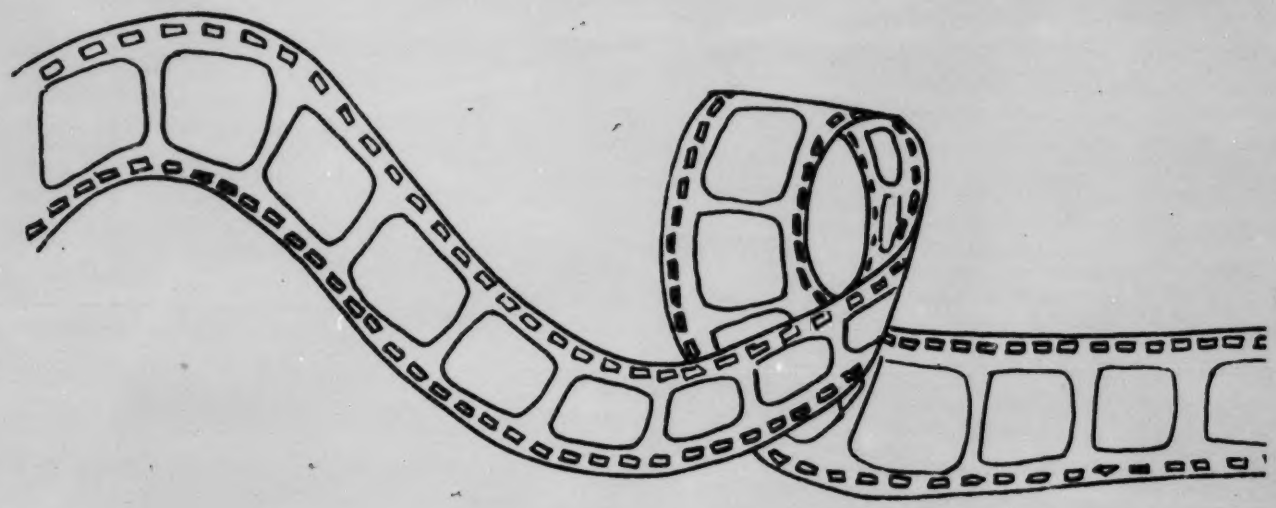


5

6

100

200

400

Metre

7

100 Metre Swim Event

8

POLICE FIND 1 KILO OF MARAJUANA

"CHILDREN HAVE to have some kind of guidance—that's the primary reason to say 'No' to them. They need to be out of your hair; you need to be able to get them to accept some limitations, and you need to protect them and demonstrate your love for them. All these needs and many more are incorporated in the ability to say 'No.' "

The speaker was Dr. Edwin S. Kessler, director of Children's Psychiatric Services at Georgetown University Medical Center in Washington, D.C. His eyes were warm and knowing behind the glasses, and his moustache and thinning hair helped to reinforce the psychiatrist's father-figure image.

"Take guidance," he continued. "The idea is to establish a set of rules that can be followed not only as a child, but later on as well. For the most part, I would say almost any child who is not given some limits, who is not helped by a judicious 'No,' is going to become undisciplined, wild, aggressive—and frightened. He doesn't know where to draw the line. A child whose instincts are permitted full sway is likely to be a terrified child. He shows signs of extreme anxiety because somehow he knows that if his parents can't help him control his impulses, *he* certainly can't. To learn some kind of control over his own strong inner impulses he must get assistance from his parents. This assistance comes by defining limits, and you define limits by saying 'No.' "

"How do you know which approach you're taking?" I asked. "Where do you draw the line between his needs and your own convenience?"

"A lot of it, of course, is common sense, and the culture helps a lot," Dr. Kessler replied. "There are certain standard things, sets of behavior that require a 'No' because the culture has established both the action and the time at which it takes place. 'No, you cannot continue to soil your diapers.'

9

10

1 GLASS OF WHOLE MILK (210 g) CONTAINS:

7.4 g	Protein
8.2 g	Fat
10.3 g	Carbohydrate
0.25 g	Calcium
0.20 g	Phosphorus
0.2 mg	Iron
0.08 mg	Thiamine
0.36 mg	Riboflavin
0.21 mg	Niacin
2.1 mg	Vitamin C

11

12

13

GET READY TO . . .

GO METRIC

14

QUANTITY	UNIT	SI SYMBOL
Length	metre	m
Volume	litre	l
Mass (Weight)	gram	g
Temperature	degree Celsius	°C

15

QUANTITY	UNIT	SI SYMBOL
Length	_____	m
Volume	_____	l
Mass (Weight)	_____	g
Temperature	_____	°C

16

QUANTITY	UNIT	SI SYMBOL
Length	metre	m
Volume	litre	l
Mass (Weight)	gram	g
Temperature	degree Celsius	°C

17

QUANTITY	UNIT	SI SYMBOL
Length	metre	m
Mass (Weight)	kilogram	kg
Time	second	s
Electric Current	ampere	a
Temperature	Celsius	C
Luminous Intensity	candela	cd
Amount of Substance	mole	mol

18

PREFIXES TO MAKE THEM smaller

PREFIX	QUANTITY	CLUE TO REMEMBER
deci-	(1/10th or 0.1)	The decimal system based on tens
centi-	(1/100th or 0.01)	The cent
milli-	(1/1 000th or 0.001)	The millipede

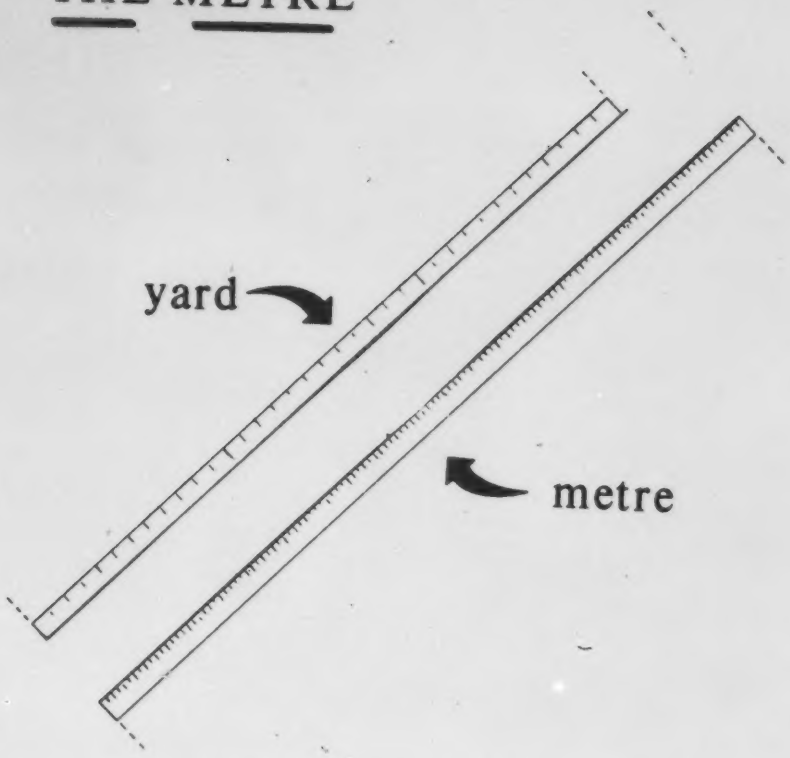
prefixes TO MAKE THEM LARGER

kilo-	x 1 000
mega-	x A million

UNIT	SYMBOL
metre	m
gram	g
litre	l

PREFIX	SYMBOL
mega-	M
kilo-	k
deci-	d
centi-	c
milli-	m

1 THE METRE

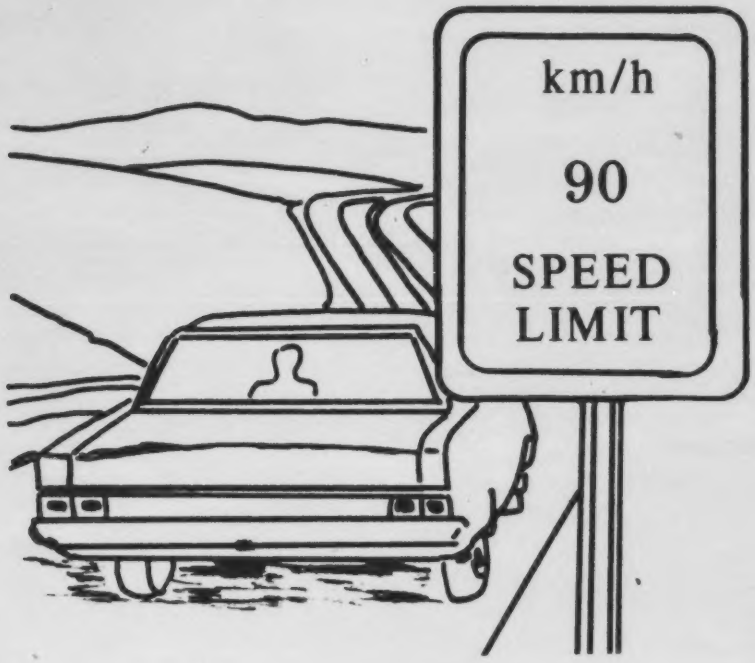


METRE REPLACES

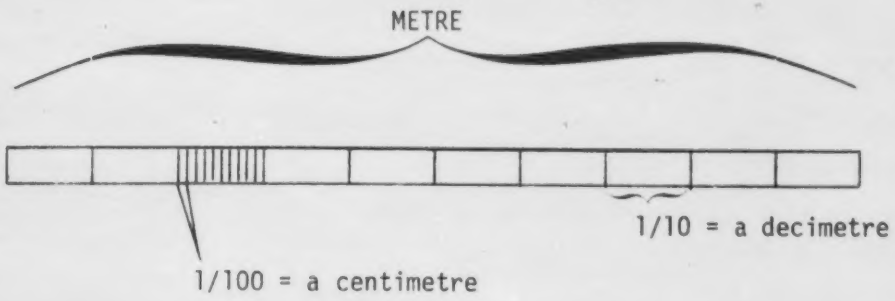
INCH
FOOT CUBIT
YARD FURLONGS
MILE SPAN
FATHOM ETC.
ROD

23

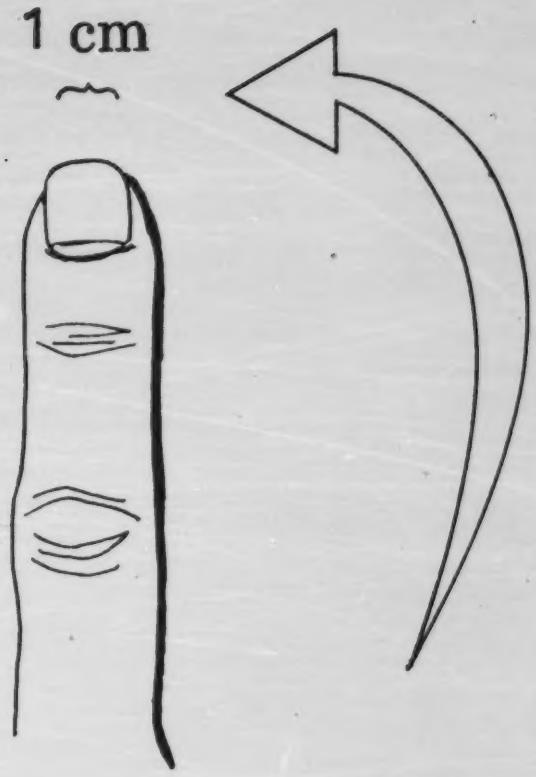
metre x 1 000 = 1 kilometre (km)



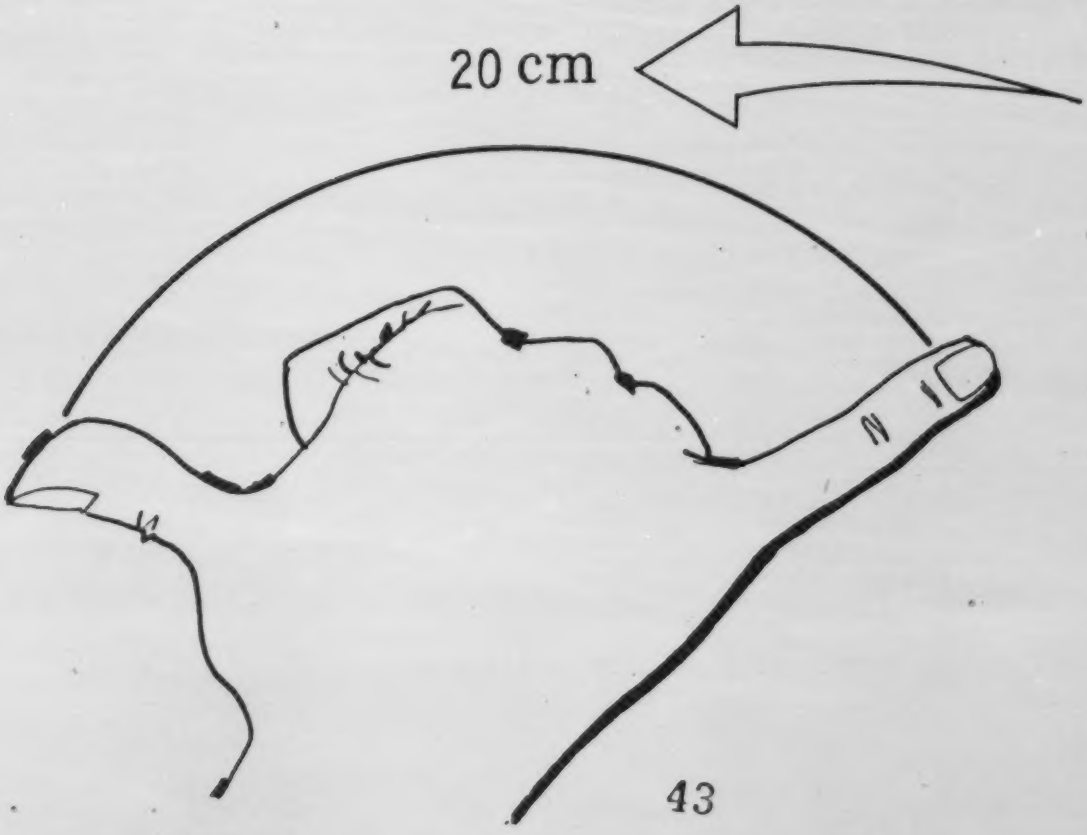
24



25

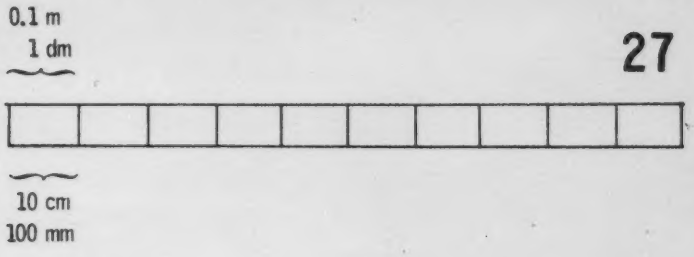


26



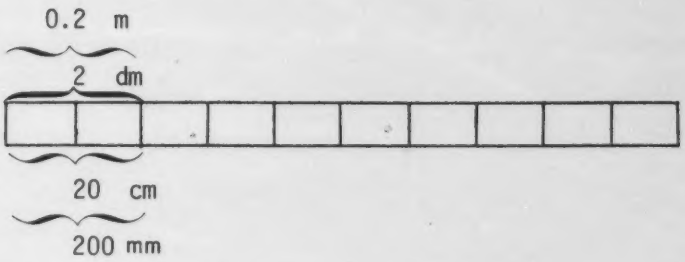
27

0.1	metre
1.0	decimetre
10.0	centimetres
100.0	millimetres



EXAMPLE:

0.2	metre
2.0	decimetres
20.0	centimetres
200.0	millimetres



28

PROBLEM:

0.4 metre

4.0 decimetres

= _____ centimetres

= _____ millimetres

29

ANSWERS: .4 metre

= 4 decimetres

= 40 centimetres

= 400 millimetres

30

REMEMBER WHEN . . .

1/4 yard

= 3/4 foot

= 9 inches

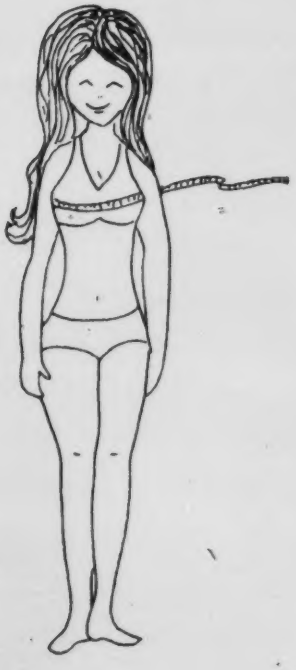
31

36 inches

3 feet

1 yard

32



0.9 metre

9.1 decimetres

91 centimetres

910 millimetres

33

REVIEW:

metre x 1 000 = _____

0.1 or 1/10 metre = _____

0.01 or 1/100 metre = _____

0.001 or 1/1 000 metre = _____

34

ANSWERS:

metre x 1 000 = kilometre

0.1 or 1/10 metre = decimetre

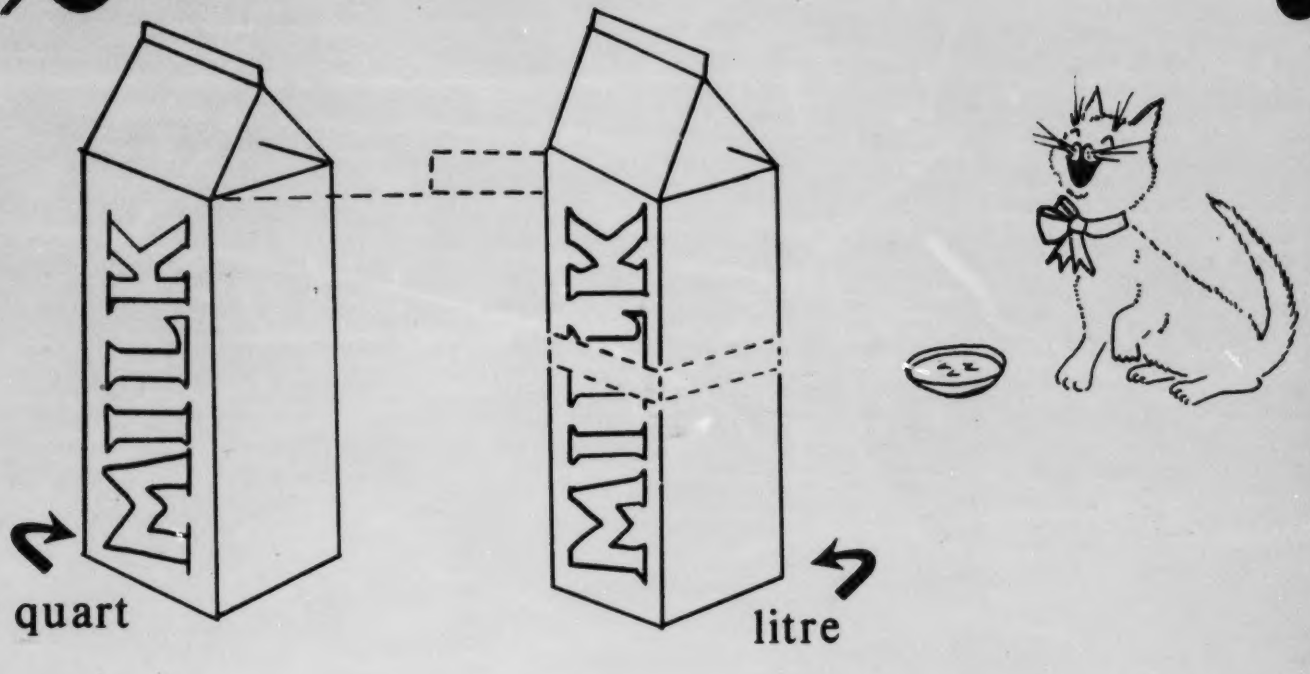
0.01 or 1/100 metre = centimetre

0.001 or 1/1 000 metre = millimetre

2

THE LITRE

35

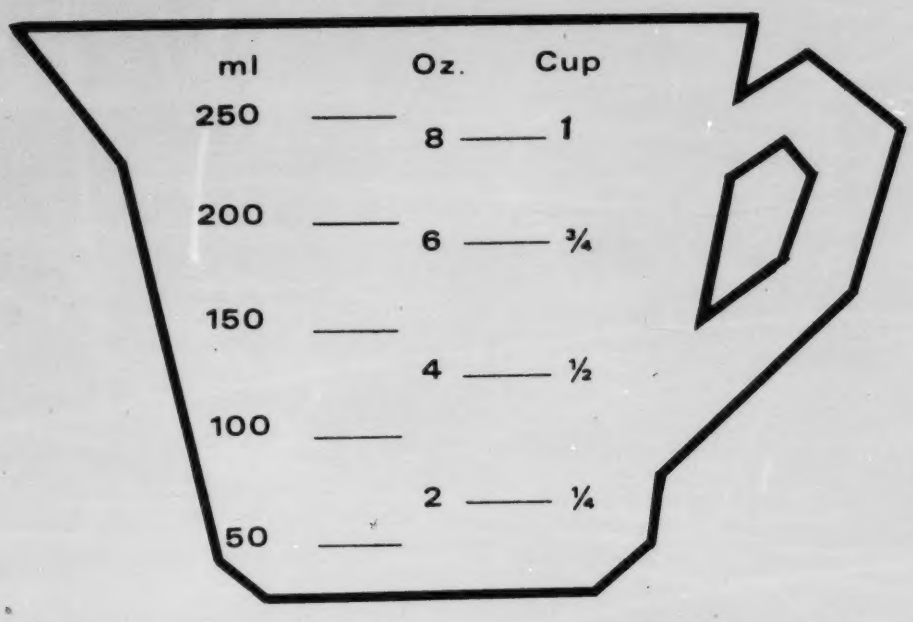


36

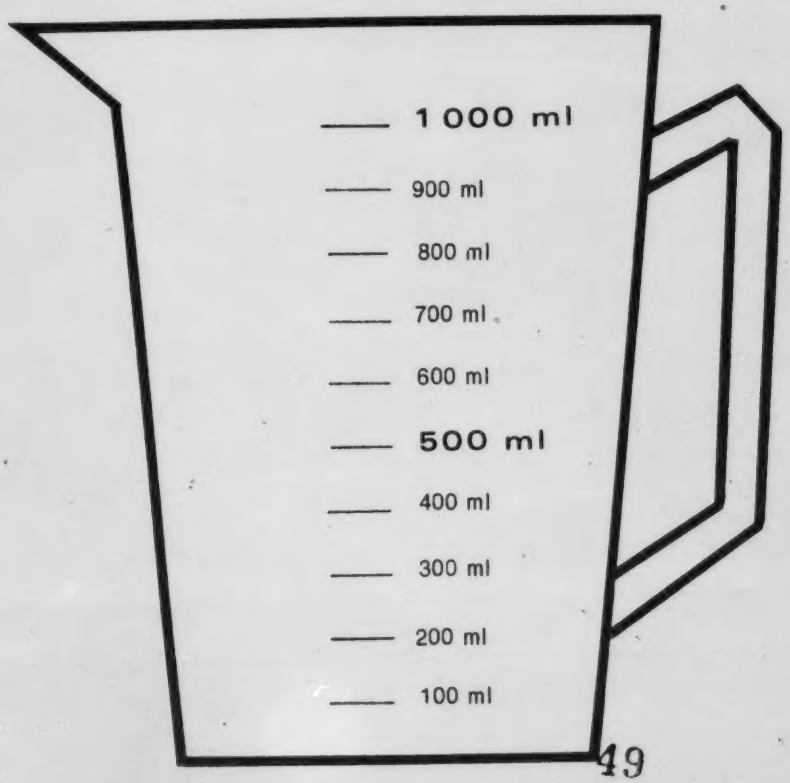
LITRE REPLACES

QUART
GALLON
FLUID OUNCE
ETC.

37



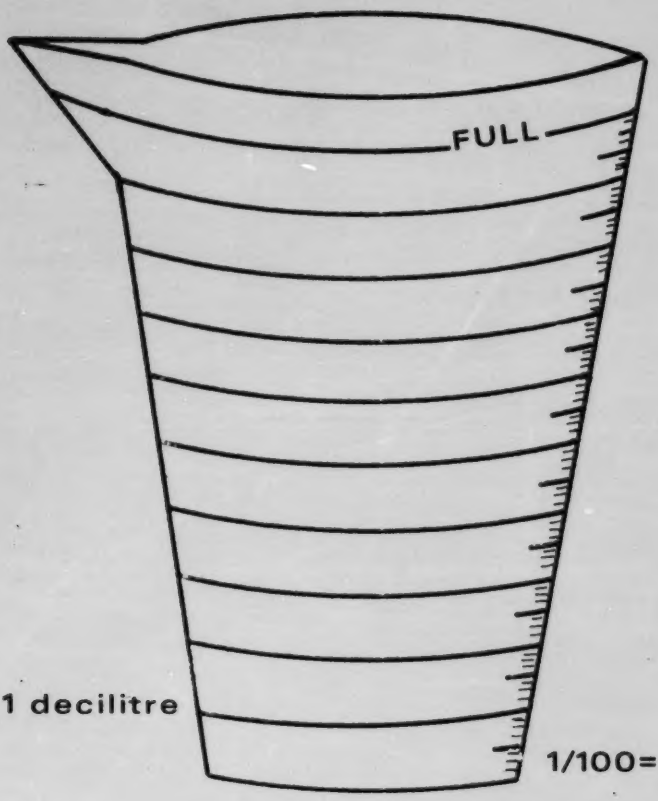
38



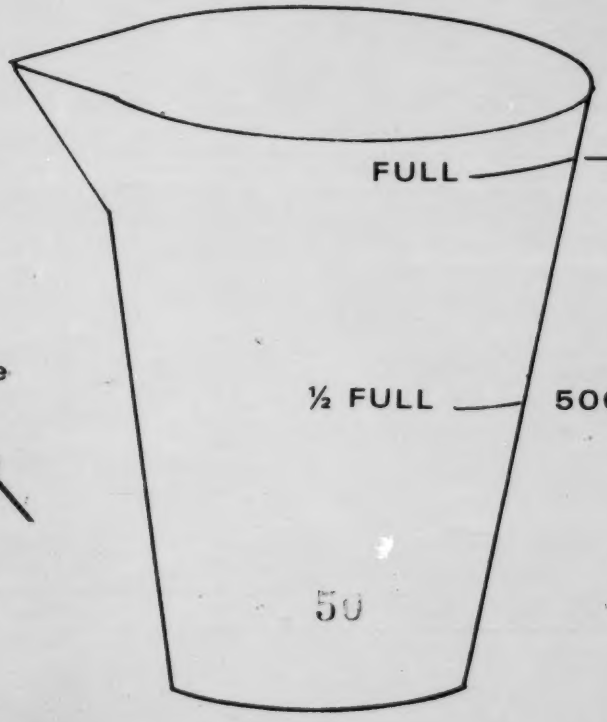
1 litre or

1 000 millilitres

39



40



~~centilitre~~

~~decilitre~~

41

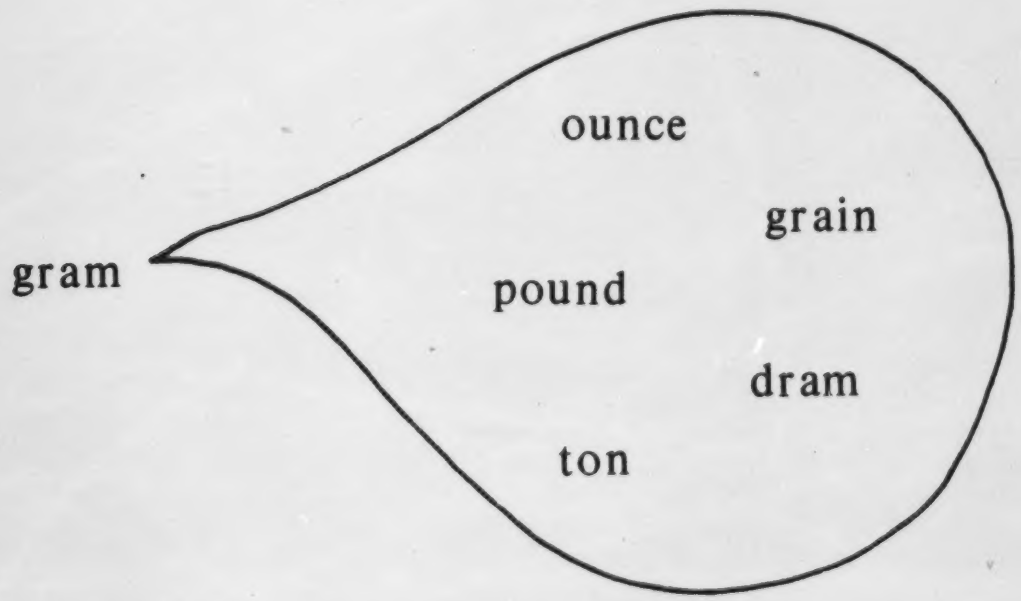
3

GRAM

. . . for mass

or weight

42



1 000 grams = 1 kilogram

1 000 g = 1 kg

1 kilogram

1 pound

45

80 kg

46

80 kg

?

80 kg

HINT: 1 kg = 2.2 pounds

47

QUICK GUESS =

160+ pounds

ACTUALITY =

176 pounds

48

REVIEW:

We metrically measure . . .

length by using the _____,

volume, or liquid, by using the _____,

and mass, or weight, by using the _____

or _____.

49

ANSWERS:

We metrically measure . . .

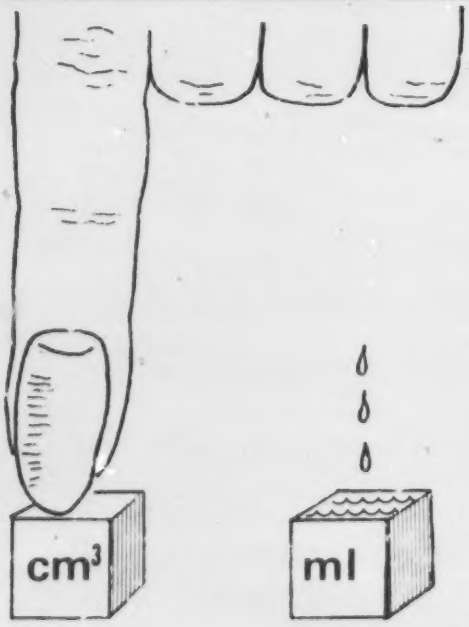
length by using the metre,

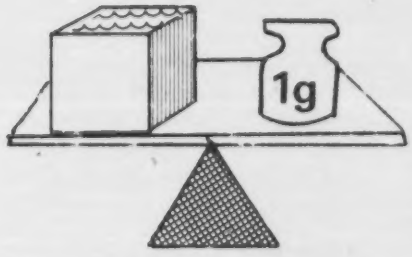
volume, or liquid, by using the litre,

and mass, or weight, by using the gram

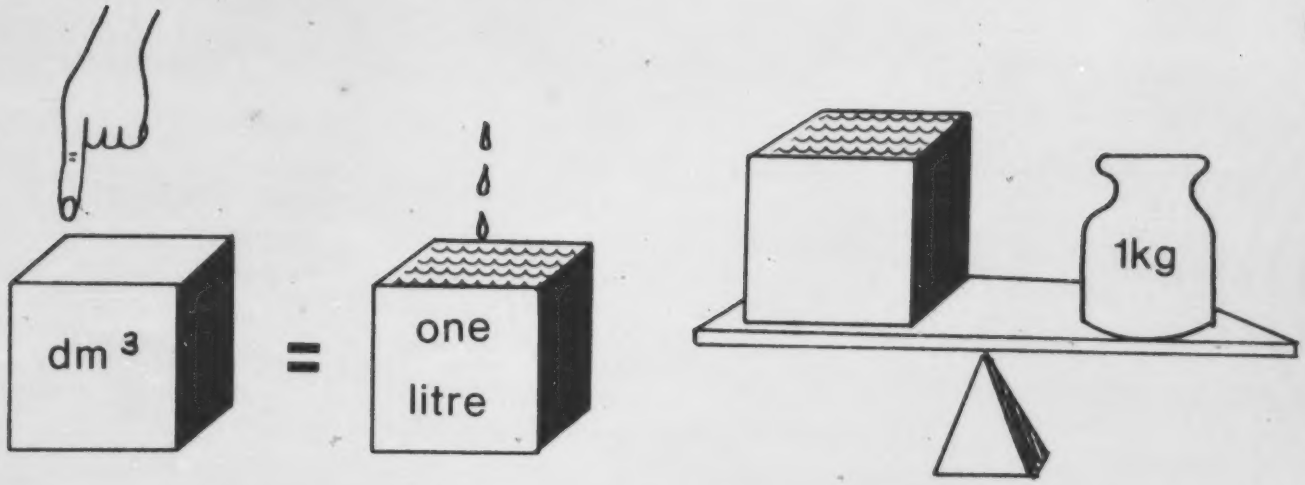
or kilogram.

50





1 cubic centimetre = 1 millilitre = 1 gram of water

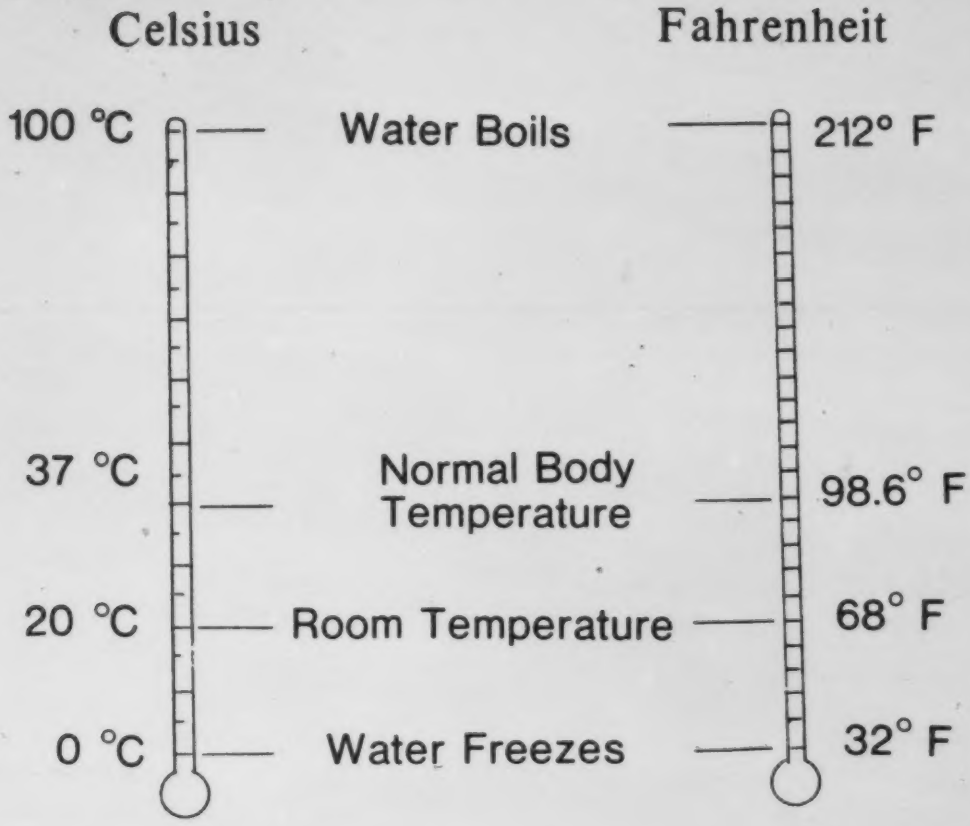


1 cubic decimetre = 1 kilogram of water

4

CELSIUS

53

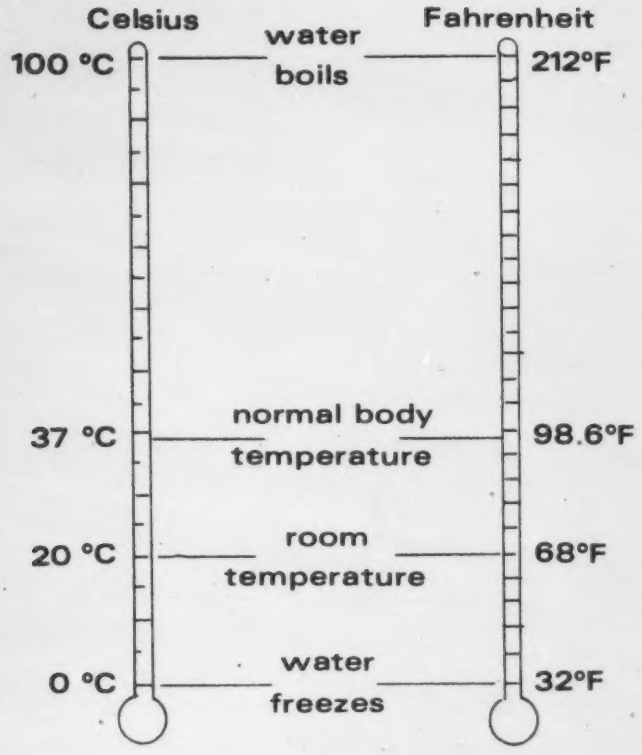


54

37 °Celsius

= Normal temperature

(or 98.6° Fahrenheit)


Celsius
Fahrenheit
100 °C
water boils
212°F
37 °C
normal body temperature
98.6°F
20 °C
room temperature
68°F
0 °C
water freezes
32°F

5 JOULE

57

A diet with a caloric value of 2,000

is approximately equal to a diet with an

energy value of 8 000 kilojoules.

Ratio:	1:4	approximately
	1:4.2	actuality

58

BASIC UNITS

PREFIXES

RULES

NO: ~~14 cm.~~

YES: 14 cm

USE NO PERIODS AFTER SYMBOLS AND ALWAYS LEAVE A SPACE BETWEEN THE NUMBER AND THE METRIC SYMBOL

NO: ~~14 cms~~

YES: 14 cm

NEVER USE AN "S" AFTER A SYMBOL.

NO: ~~14 CM~~

YES: 14 cm

THE SYMBOLS SHOULD BE IN LOWERCASE EXCEPT FOR THOSE DESIGNATED.

(However, yes to: C for Celsius)

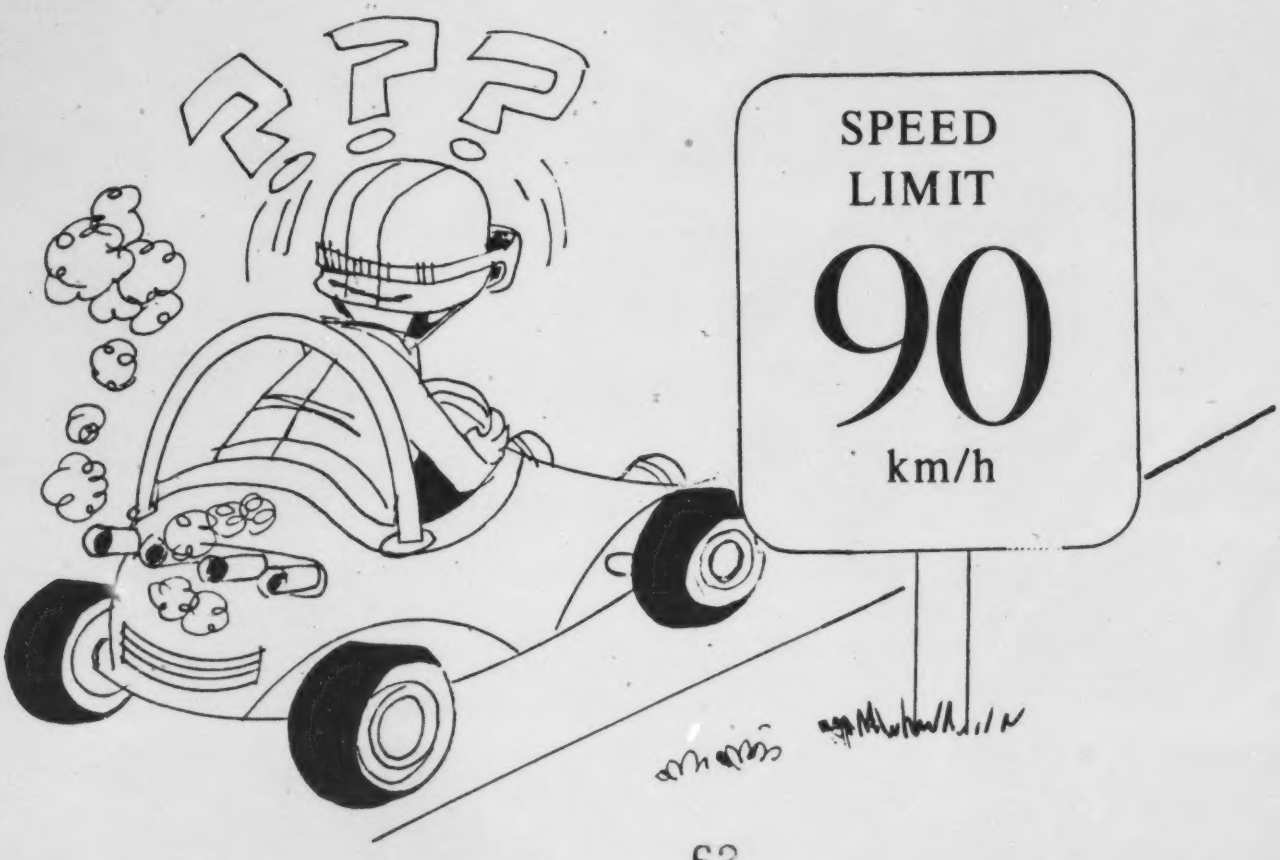
63

NO: ~~14,000 km~~

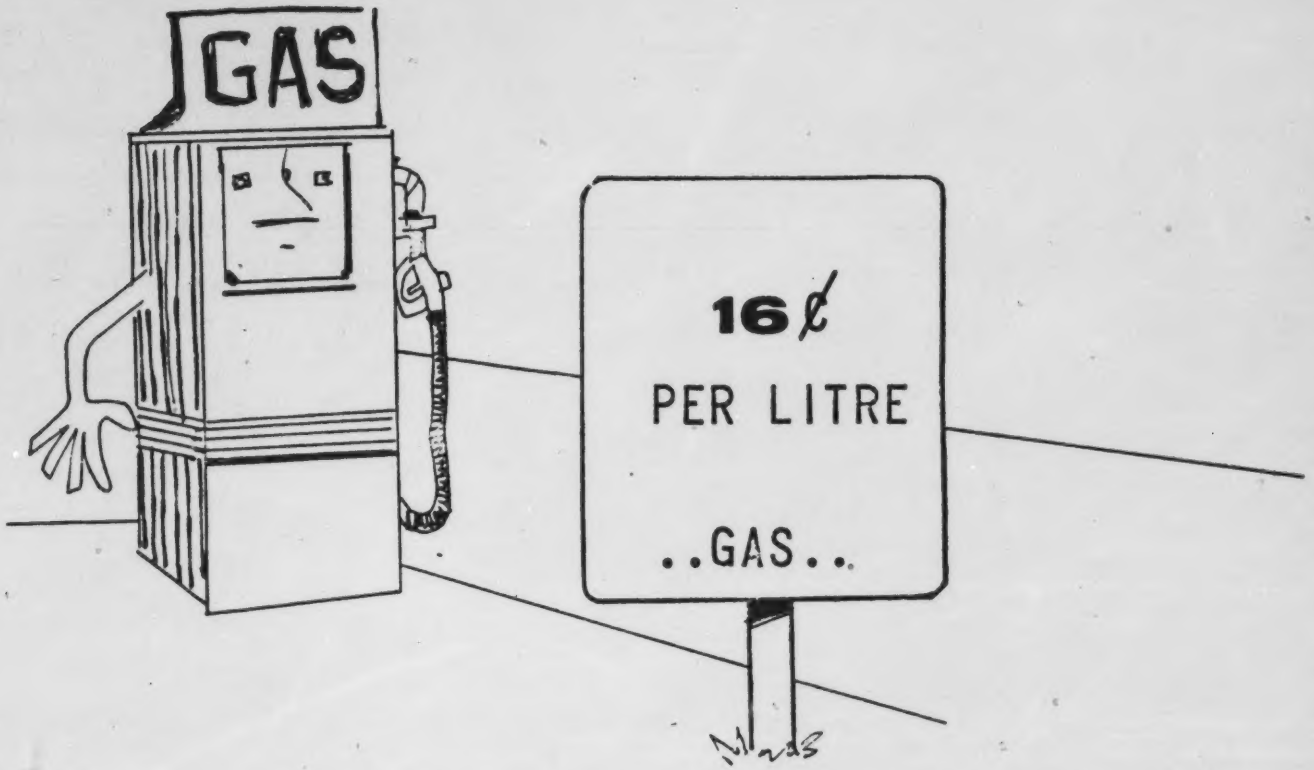
YES: 14 000 km

COMMAS SHOULD BE OMITTED IN FIGURES REPRESENTING LARGE AMOUNTS.

64



65



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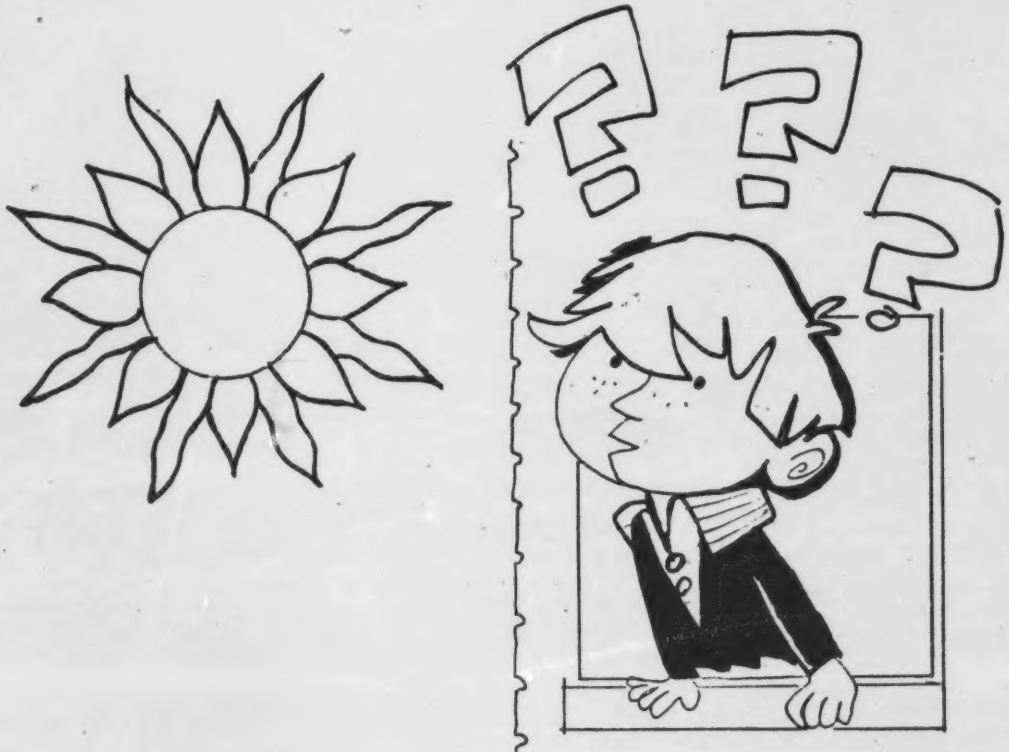
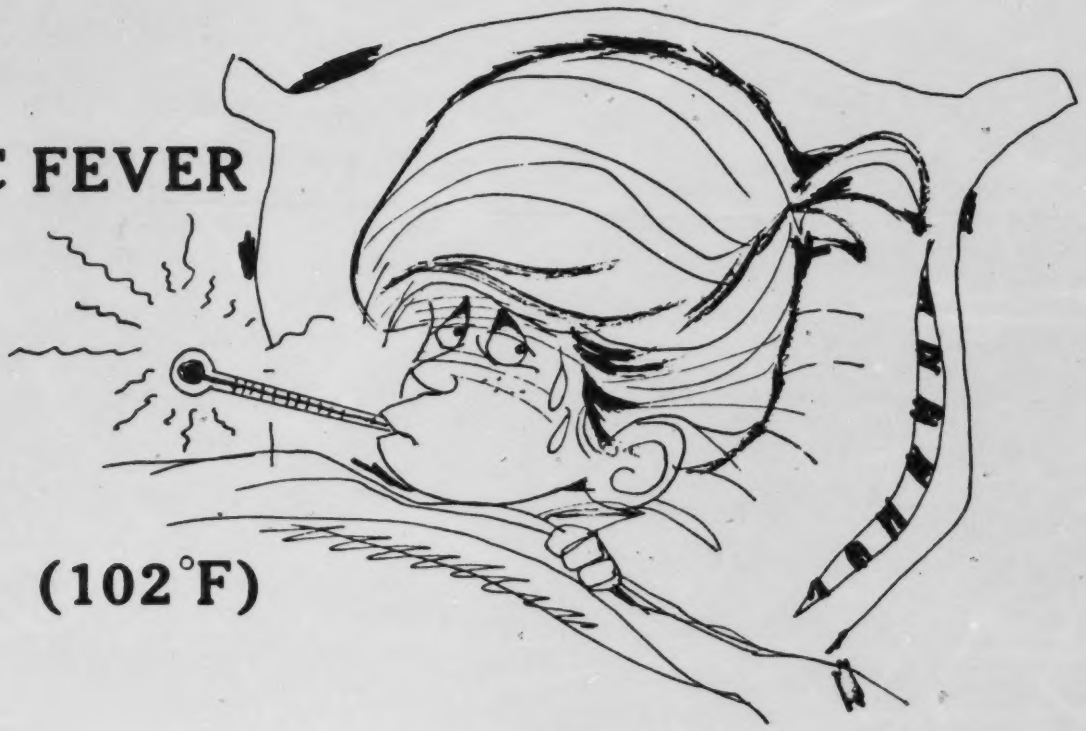
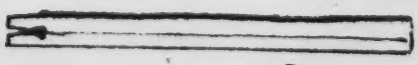


67



68



64

69

BUST 87 cm

WAIST 65 cm

HIPS 92 cm

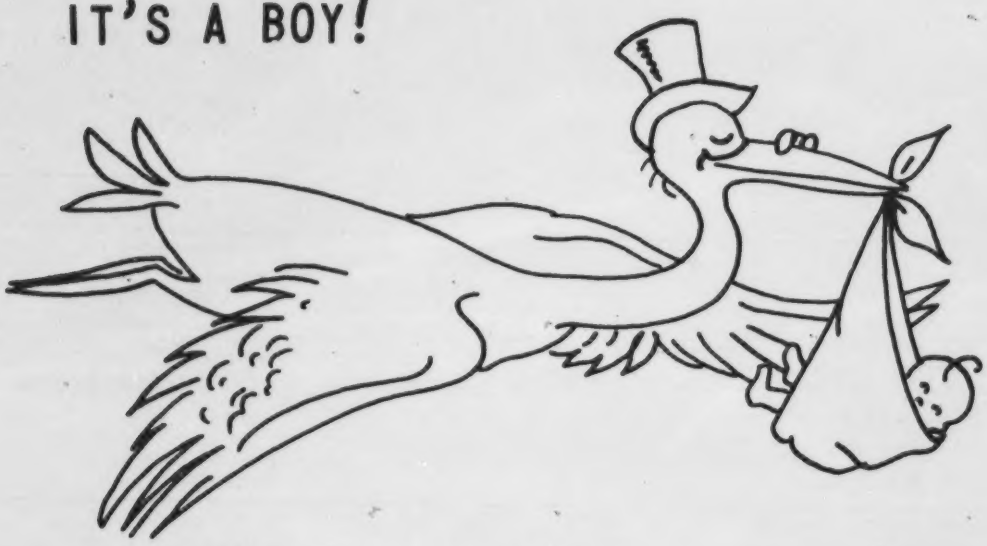
70

100 kilograms

50 kilograms

71

IT'S A BOY!



WEIGHT: 3.1 kg

LENGTH: 49 cm

72

Happy metrication!

Transparencies and script

presented by

Orange County Department of Education

PART III: LEARN BY DOING

INSTRUCTIONS TO TEACHER

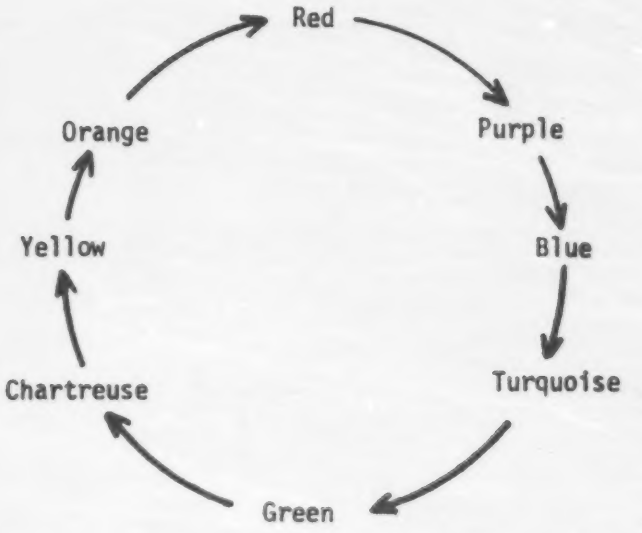
- The "learn-by-doing" session may be preceded by some examples of the various experiments.

- Distribute color chips to divide participants into 8 groups. A paper placement of colors can identify the various stations.

LEARN BY DOING

As each participant in today's workshop entered the door, he/she received a color coded tag. The color received will indicate the station in which to begin participation in the "round robin" presentation of activities.

The following will be the direction of progress in the "round robin":



Information will be available at each station. With no further instructions, please begin!

STATION: RED -- "BODY MEASUREMENTS"

Supplies at the station:

- -CHEA personal measurement cards (see reference section page 62)
- -tape measures
- -height chart on wall
- -box for leveling height
- -bathroom scale

Steps:

1. Using the CHEA personal measurement card provided, fill in the blanks as to height, weight, and body dimensions as indicated.

2. Answer: I am _____ cm tall.

   _____ m tall.

Example: I am 164 cm
1.64 m

   Which of the above measurements would become the most commonly used? _____

3. My bust/chest measurement is _____ mm, _____ cm, _____ m.

   Which measurement would become most commonly used? _____

4. Have you ever considered a 3-foot bustline or a yard bustline?

5. Guess the height of the person next to you. _____ cm
   Now, measure to see how close you were.
   Actual measurement was: _____ cm
   How far off was your guess? _____ cm

STATION: PURPLE -- "VOLUME"

Supplies at the station:

-metric measuring utensils (3)
-full, capped Coke bottle
-empty Coke bottle (3)
-litre wine flask
-large container with "?"
-tea cup (1)
-drinking glass (1)
-large container for water (or sink)

Steps

1. Fill the measuring utensil with 100 ml. Pour this into the empty Coke bottle.

   Now estimate with your eye how many ml in the full Coke bottle? _____ ml

2. To check your estimate, fill the empty Coke bottle until it is even with the full, capped bottle. Pour the water back into the measuring utensil to measure the contents of the bottle.

   What are the actual contents of the Coke bottle? _____ ml

   How far off was your guess? _____ ml

3. In measuring typical servings, decide upon an amount which could be used in millilitres for the tea cup. Attempt to use whole numbers.

   _____ ml = an average tea cup serving

4. In measuring typical servings, decide upon an amount which could be used in millilitres for the drinking water. Attempt to use whole numbers.

   _____ ml = an average drinking glass serving.

5. Fill the wine flask with exactly one litre.

   By visualizing what one litre "looks like," attempt to guess for the contents in the large container marked "?".

   Write your guess here: _____ ml
   A prize will be given later for the closest guess!

STATION: BLUE -- "WEIGHING FOOD"

Supplies at the station:
-metric scale for measuring (1)
-bag of potatoes
-1 banana

Steps:

1. Approximately how many potatoes weigh 1 kg? _____

2. What is the average weight of one potato? _____ g
   (hint: Weigh 3 potatoes and divide by 3.)

3. At the grocery store the potatoes are marked:

20¢/kg Potatoes

   How much would 500 g of potatoes cost? _____ ¢

   How much would 250 g cost? _____ ¢

   Weigh 6 potatoes. Approximately how much would they cost? $ _____

4. How much does one banana weigh? _____ g

5. How many bananas would it take to weigh 1 kg? (est.) _____

STATION: TURQUOISE -- "PACKAGE LABELING"

Supplies at the station: Miscellaneous grocery items marked conventionally and metrically

Steps:

1. Observe the grocery items. The quantities are listed conventionally as well as metrically. Classify groceries according to solids, liquids, and semi-solids. What measurement units were used?

Grocery Item	Solid	Liquid	Semi-solid	Metric Unit Used

2. What printing errors were observed?

_____ should have been _____ on the container of _____.

_____ should have been _____ on the container of _____.

_____ should have been _____ on the container of _____.

_____ should have been _____ on the container of _____.

_____ should have been _____ on the container of _____.

STATION: ORANGE -- "ACCURACY OF METRICS"

Supplies at the station:

-metric scale (2)
-flour
-dry measuring cups (2 sets)
-sifter (2)
-metal spatula (2)
-wax paper
-dampened dish cloth
-large spoon (2)

Steps:

1. Measure and weigh 1 cup of flour by the following methods:
   (a) Scoop flour out of canister with measuring cup, level off and weigh.

   1 cup flour weighs _____ g

   (b) Sift flour onto wax paper, spoon lightly into the cup, level and weigh.

   1 cup flour weighs _____ g

   (c) Sift flour directly into the cup (hold over a piece of wax paper to catch spillage), level and weigh.

   1 cup flour weighs _____ g

2. Did the three measurements differ in weight? The difference between the lowest and the highest weight was:

   Highest weight = _____ g
   - Lowest weight = _____ g
   = Difference = _____ g

3. Compare the results of method 1(b) of measurement obtained by other participants:

   Participant 1: _____ g
   Participant 2: _____ g
   Participant 3: _____ g

   The difference between the lowest and highest value was _____ g.

4. How accurate is measuring ingredients by volume?

5. How accurate is measuring ingredients by mass/weight?

6. Were there any major difficulties in using the scale? (See page 55 for further information.)

STATION: GREEN -- "GARMENT CONSTRUCTION"

Supplies at the station: -pattern envelope in metrics (see page 63)
-pattern piece

Steps:

1. What is the metric seam allowance on the pattern piece? _____ cm

   Had you ever noticed that designation on a pattern before? _____

According to the pattern envelope, answer the following questions:*

2. The metric unit for measuring length is the _____ .

3. What are the body measurements for a size 12?

   _____cm, _____cm, and _____cm

4. What are the standard fabric widths listed?

   _____cm, _____cm, _____cm, and _____cm

5. The finished length of the pants at the side seam of a size 10 would be _____ cm.

6. For a size 12 you would need _____ cm of 2 cm wide elastic.

*These questions were contributed by Lynda Monroe Ellingson, student, California State University, Long Beach.

STATION: YELLOW -- "TEMPERATURE"

Supplies at the station:
- -5 thermometers (range of -10 °C to 110 °C)
- -bowl of ice water
- -pan with hot water
- -12 disposable coffee cups
- -container for waste water

Steps:

1. Pour the ice water into a cup and record temperature. . . . . _____ °C
   Feel it with your fingers.

2. Pour the hot water into a cup and record temperature. . . . . _____ °C
   Feel it with your fingers.

3. Pour some hot water and some cold water together in
   a third cup. Feel it. Guess the temperature. Record . . . . _____ °C
   Now measure the temperature to see how close you were . . . . _____ °C

4. Repeat No. 3. Use different amounts of hot and cold
   water. Feel it. Guess the temperature. . . . . _____ °C
   Now measure the temperature to see how close you were . . . . _____ °C

STATION: CHARTREUSE -- "LENGTH"

Supplies at the station: -cookie sheet
-3 metre sticks

Steps:

1. Make your own "body ruler":

   Which of your fingernails is almost 1 cm wide? _____

   How far is your span between the end of your thumb and the end of your little finger? _____ cm

   Extending your arm out, from the tip of your middle finger, where does a metre measure on you?

   Check: ____ To your nose (facing forward)?
   ____ To your opposite ear?
   ____ To your opposite shoulder?
   ____ Other _____

   Measure the length of your pace (average step). Measure from the back of your heel on each step. My pace is _____ cm.

2. Using your "body ruler" estimate the size of the cookie sheet.
   _____ x _____ cm

3. Using the metre stick, what is the average working height of a table where you would be sitting? _____ cm

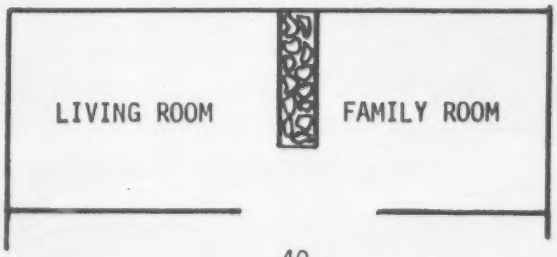
4. What is the chair's sitting height? _____ cm

5. Measure the counter height. _____ cm

6. The following floor plan is drawn to scale of 1 cm: 1 m.

   What are the measurements of the living room? _____ m x _____ m

   How many square metres of carpet would you order for the family room?
   _____ m^2



CONCLUSION OF "LEARN BY DOING"

1. Give the prize to the person who made the closest guess as to volume of the "?" container.

2. Distribute the post-test.

3. Answer any questions.

METRIC POST-TEST

Attempt to answer the questions without any aids the first time through. Then, you may consult your workshop papers to aid you in answering the following questions:

1. The metric unit used in measuring length is the _____.
2. The metric unit used in measuring mass (weight) is the _____ or _____.
3. The metric unit used in measuring volume (liquids) is the _____.
4. The metric degree of temperature is called _____.
5. To divide any of the basic units into 100 sections, the prefix _____ is used.
6. To divide any of the basic units into 1 000 sections, the prefix _____ is used.
7. To multiply a basic unit by 1 000, we use the prefix _____.
8. Driving distance would be measured by _____.
9. The approximate distance from the tip of <u>your</u> thumb to the tip of your little finger is _____ cm.
10. Using your "body rulers" the width of this paper is approximately _____ cm.
11. Normal body temperature is _____ ^{o}C.
12. How much did you weigh? _____ kg
13. How tall were you? _____ cm
14. What is the seam allowance on a pattern? _____ cm
15. What is comfortable room temperature? _____ ^{o}C.

PART IV: REFERENCE MATERIALS

GLOSSARY AND ANNOTATIONS

ADDITIONAL CLASSROOM ACTIVITIES

- BULLETIN BOARDS
- CHALKBOARD STATEMENTS
- CLASSROOM ACTIVITIES

CONVERSION CHARTS AND OTHER REFERENCES

SOURCE OF METRIC SUPPLIES

BIBLIOGRAPHY

GLOSSARY AND ANNOTATIONS

Calorie vs. kilojoule

The International System of Units considers it preferable to adopt the joule and avoid the use of the calorie. Watch for further guidance on this matter!

calorie: The calorie is the amount of heat required at a pressure of one atmosphere to raise the temperature of one gram of water one degree Celsius.

Calorie: (With a capital C, or the kilocalorie) The Calorie is the amount of heat required to raise the temperature of one kilogram of water one degree Celsius. (This is the unit of common usage with the consumer.)

joule: (Unit of energy or work) The joule is the amount of work done when an applied force of one newton moves a body through a distance of one metre in the direction of force.

Conversion Aids:

1 calorie	=	4.186 joule
1 Calorie (or kilocalorie)	=	4 186 joule or 4.186 kilojoule

For consumer use:

1 Calorie	=	4.186 kilojoule

gram

Since the unit "gram" is so small, the official basic unit for mass is the "kilogram." There is greater ease in understanding the prefixes when the gram is introduced as the basic unit (as was done in this manual).

hectare

Not mentioned elsewhere in this manual is the unit for measuring land surfaces. The "hectare" (symbol = ha) is defined as an area of 10 000 square metres and may be thought of as representing a square of which each side measures 100 metres.

kilometre

SI recommends that the accent fall on the first syllable to be consistent with other metric terms. (kill-oh-meet-er)

liter or litre?
meter or metre?

There is a growing trend to spell the words in the international manner: litre and metre. Watch for official direction on this matter.

mass vs. weight

Suggest: Weight in the past has been defined by scientists as the force of gravity. It has been commonly used as though it were the same as mass. Scientists will be discontinuing its use as a force, leaving the word weight for consumer use as synonymous with mass.

"Soft" Conversion/"Hard" Conversion

When we talk about going metric, we really have to consider two kinds of changes, "soft" and "hard." A soft change is simply a trade of one measurement language for another. Example: a foods container marked "16 oz. (454 g)." "Hard" conversions involve hardware changes which alter sizes, weights, and other dimensions of physical objects. Example: a foods container marked "500 g (17½ oz.)."

Uppercase Symbols:

The metric symbols are generally given in lowercase letters. The following are the symbols for commonly used units that are exceptions to the rule:

A	ampere	W	watt
K	kelvin	J	joule
°C	degree Celsius	V	volt

* * *

HISTORICAL ENGLISH TERMS AND EQUIVALENTS

- the Biblical cubit = the length of a man's forearm.
- the Egyptian digit = the width of a finger.
- the rod = 5-1/2 yards or 16-1/2 feet. In the 16th century, the length of a rod was determined by lining up 16 men, left-foot-to-left-foot, as they left church on Sunday morning.
- the inch = the length of three barley corns, round and dry, taken from the center of the ear and laid end-to-end.
- the foot = 2/3 of the original cubit (see cubit above).
- the English furlong = 40 rods long (see rod above). The furlong was used in farming.
- the English yard = the distance from the point of the nose to the end of the thumb of King Henry I. Later Henry VII ruled the yard to be 3 feet.
- the English fathom = the length across a man's two arms outstretched. The fathom was used in sailing.

BULLETIN BOARD IDEA

SOME COMMON UNITS

	LENGTH	MASS	VOLUME	TEMPERATURE	ELECTRIC CURRENT	TIME
METRIC	metre	kilogram	litre	Celsius	ampere	second
CUSTOMARY	inch foot yard fathom furlong cubit rod	ounce pound ton grain dram	fluid ounce teaspoon tablespoon gill cup pint quart gallon barrel peck bushel	Fahrenheit	ampere	second

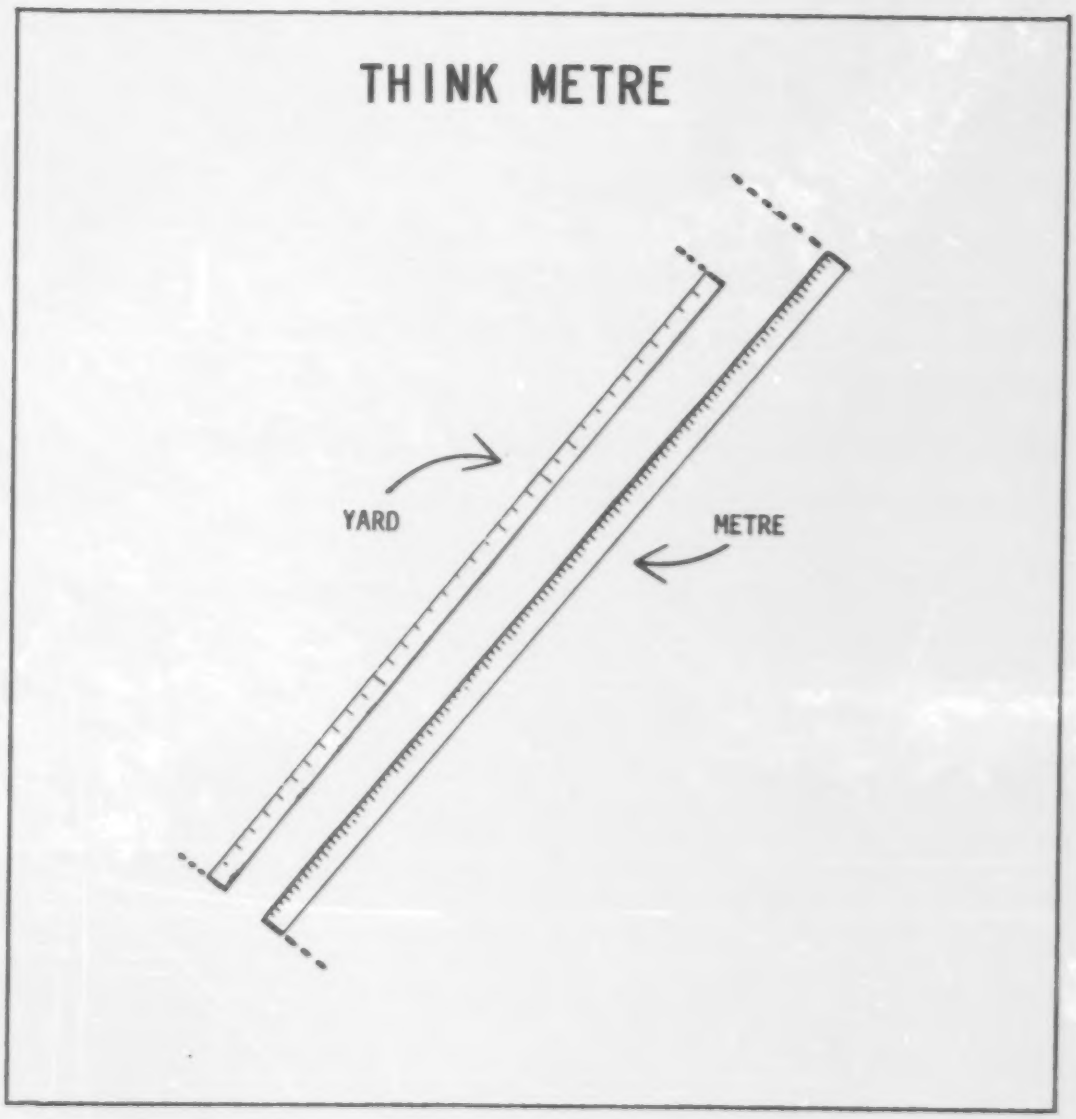
METRIC USAGE

QUANTITY	PREFIX	LENGTH	VOLUME	WEIGHT (MASS)
x 1 000	kilo-	kilometre	*	kilogram
x 100	hecto-	*	*	*
x 10	deka-	*	*	*
		METRE	LITRE	GRAM
÷ 10 (.1)	deci-	*	*	*
÷ 100 (.01)	centi-	centimetre	*	*
÷1 000 (.001)	milli-	millimetre	millilitre	milligram

*not commonly used

BULLETIN BOARD IDEA: "THINK METRE"

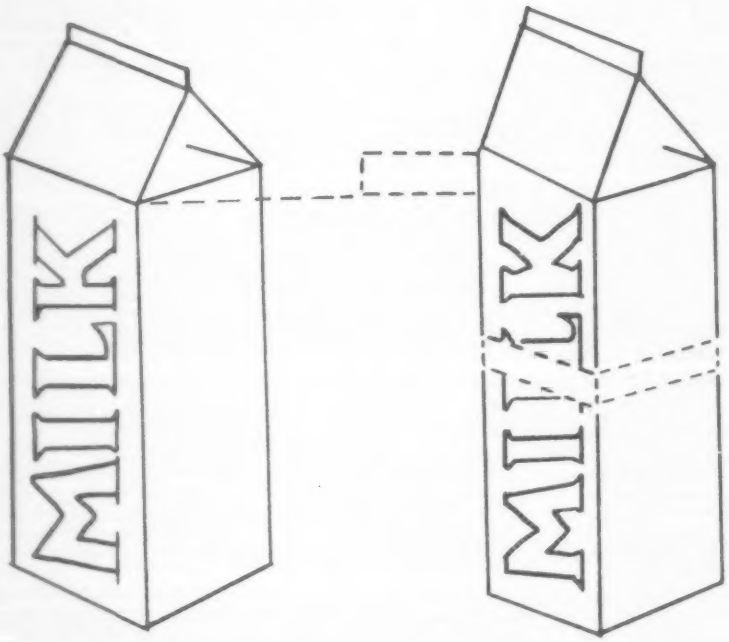
Place a metre stick next to a yard stick. Label each accordingly.



BULLETIN BOARD IDEA: "THINK LITRE"

Save two quart milk cartons and rinse well. The milk carton will measure approximately 20 cm in height to the break of the cardboard. Slash the carton in the center and extend by 1 cm. Re-wrap if necessary to give the carton support. Label the unchanged carton "quart" and label the changed carton "litre." Draw a line across from the top of each to show the change more dramatically. (There is difficulty in noting the difference by vision alone.)

THINK LITRE

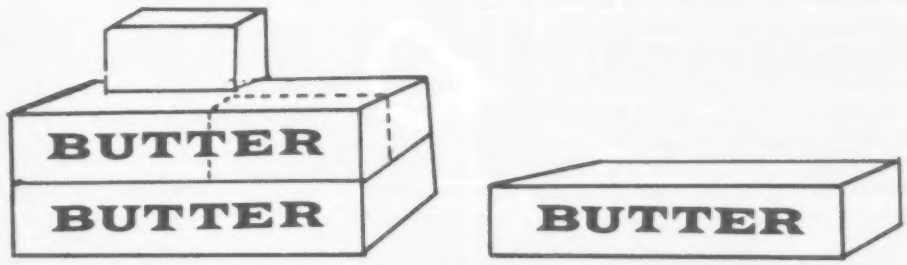


QUART LITRE

BULLETIN BOARD IDEA: "THINK KILOGRAM"

Save butter cartons. Butter is one of the few common household items that most people can visualize as to weight. Label 1 container "1 pound." Cut off 1.6 cm (5/8 in.) of 1 cube of butter and stack on top of 2 pound cartons to represent 1 kg of butter.

THINK KILOGRAM

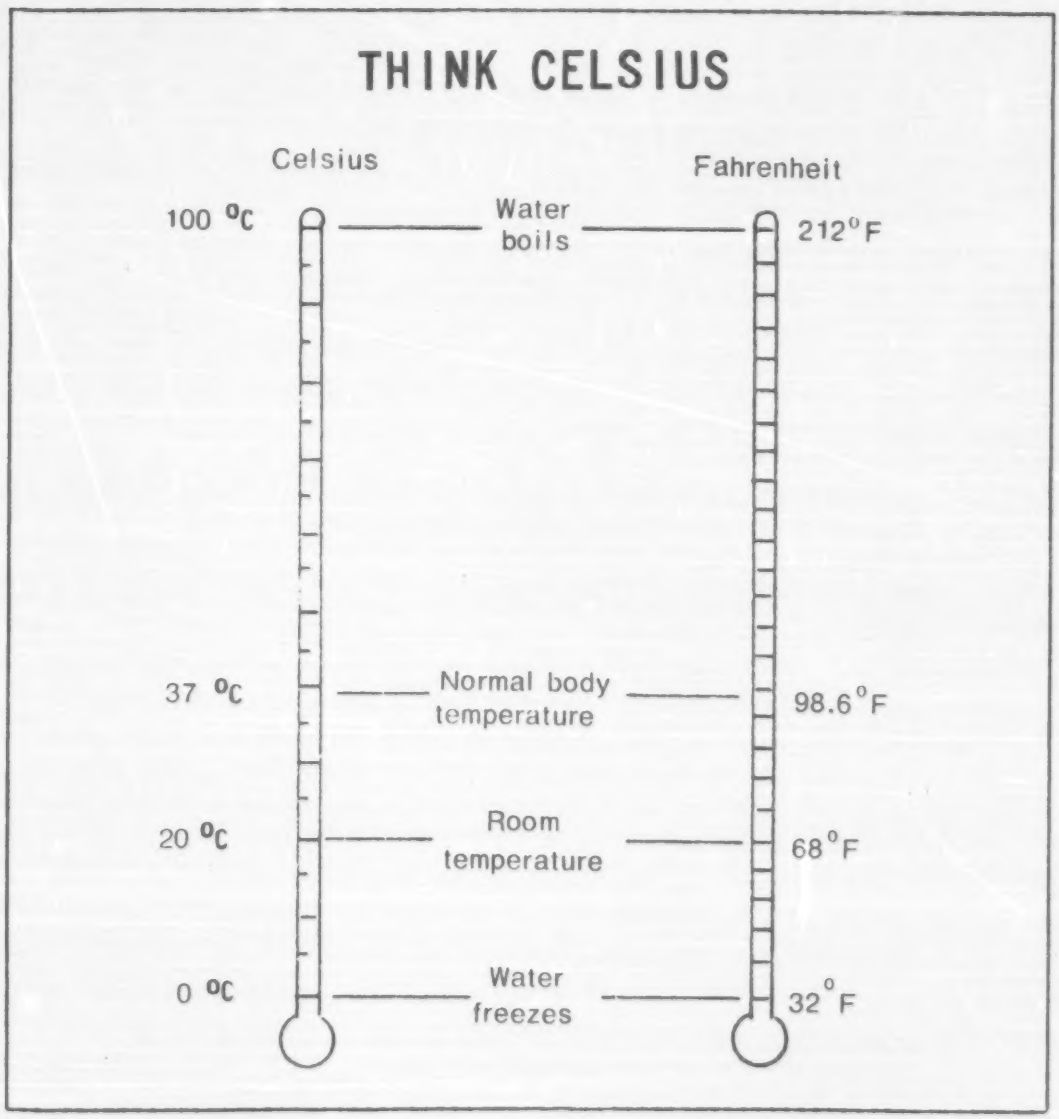


ONE KILOGRAM OF BUTTER

ONE POUND OF BUTTER

BULLETIN BOARD IDEA: "THINK CELSIUS"

Copy the following drawing by use of an opaque projector (or draw freehand). Label various temperatures accordingly.



TEACHING AIDS: CHALKBOARD PHRASES

While discussing the metric system, daily write a new song, phrase, or cliché on the board with metric measurements replacing the standard conventional measurements. With a conversion chart nearby, encourage the students to think of the original phrase.

"I wouldn't touch you with a 3 metre pole."

"Johnny, did you mow the back metre?"

"A gram of prevention is worth a kilogram of cure."

"I'd walk a million kilometres for your smile."

"Give him a centimetre and he'll take a metre."

(song title) "155 cm, Eyes of Blue"

(birthday) "...and a pinch to grow a centimetre."

"More bounce to the gram"

"He wouldn't budge a centimetre."

"There was a crooked man and he walked a crooked kilometre.

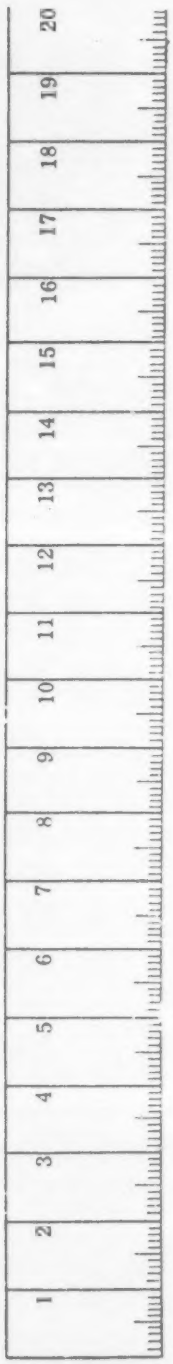
(book/movie title) "Celsius 232"

(movie title) "96 000 km Under the Sea"

(song title) "I love you 30 litres and 7 litres"

TEACHING AID: CENTIMETRE RULER

Duplicate this page. Cut out the printed 20 cm ruler. Have students glue to cardboard to use for basic measuring exercises.



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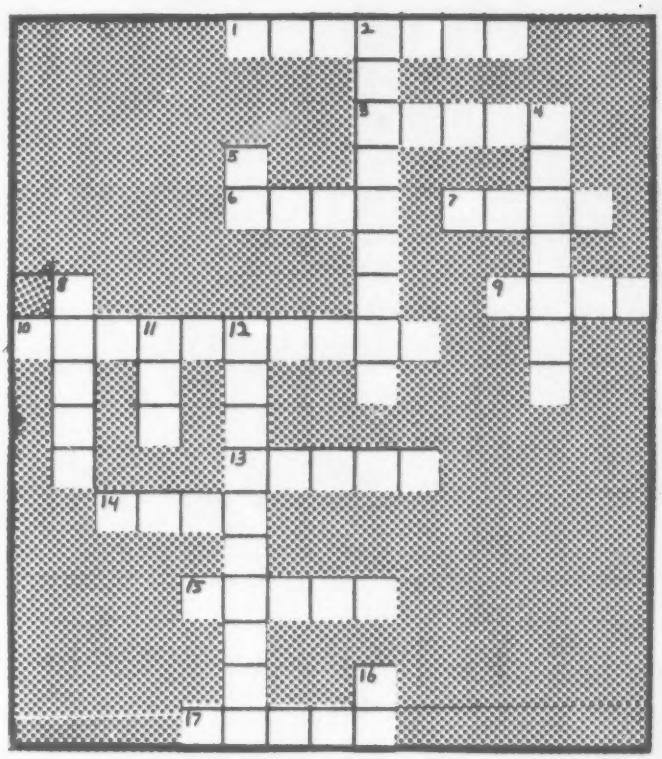
TEACHING AID: METRIC CROSSWORD PUZZLE



Horizontal

1 The number of centimetres in a metre

3 A litre is measured as 1 000 _____ centimetres.

6 A unit for mass or weight

7 Prefix meaning X 1 000

9 Second is a measure of ____

10 Unit equal to 10 millimetres

13 A unit used for volume

14 The prefix for 1/10th

15 The prefix for X 100

17 The prefix for 1/100th

Vertical

2 1/10th of a metre

4 The name of the metric temperature scale of 100 degrees

5 Symbol for 1 000 grams

8 The unit of linear measurement in the metric system

11 The entire metric system is based on multiples of _____.

12 The unit for 1/1000th of a metre

16 Abbreviation of the International System

KEY

Horizontal

1 hundred
3 cubic
6 gram
7 kilo
9 time
10 centimetre
13 litre
14 deci
15 hecto
17 centi

Vertical

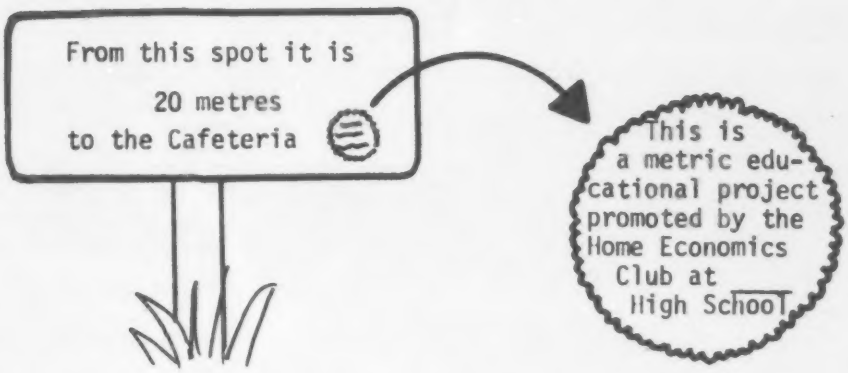
2 decimetre
4 Celsius
5 kg
8 metre
11 ten
12 millimetre
16 SI (System International)

This crossword puzzle was adapted from one developed by the Consumer Homemaking Department at Troy High School, Fullerton Union High School District.

SCHOOL ACTIVITY

The Home Economics Club or FHA on campus could initiate the following activities.

1. Measure and put up signs on campus as to the metric distance. Example:


From this spot it is
20 metres
to the Cafeteria
This is a metric educational project promoted by the Home Economics Club at ____ High School

2. A metric booth could be set up on campus during lunch time for students to weigh and measure themselves. Explanatory material should also be provided. Centimetres can be marked out on a strip of butcher paper which can be taped to the wall for measuring heights. A metric bathroom scale can be purchased for this occasion.

REFERENCE: MEASURING FOOD

Volume versus weight in preparing recipe ingredients has become a debatable question.

American homemakers are accustomed to using volume measurements for both dry and liquid ingredients when measuring recipes. This system has been quite satisfactory except for the special needs of dietitians, food testers, and those on special diets. Some inefficiencies exist in volume measuring as a result of individual differences, i.e., sifting of flour, packing of brown sugar, and the pressing of "bubbles" out of shortening.

Measuring recipe ingredients by weight would appear to solve the problems just listed. An ideal cooking scale might have a deep dish which could easily measure, for example, 100 grams of flour, 30 grams of sugar, and 5 grams of baking powder, totaling 135 grams. These dry ingredients could be mixed in the measuring dish together with the addition of the liquid ingredients. Only two containers need to be cleaned. Time would also be saved by not having to sift the flour, etc.

As advantageous as this system appears to be, it is overcome by pure economics. A scale measuring in 1 gram increments would be quite costly (approximately $30-$40). Scales in a price range of $5-$10 weigh in increments of 10, 50, and often 100 grams. The major reason for weighing foods--to increase efficiency--would obviously be lost.

It is the opinion of the writer that the American system of measuring recipe ingredients by volume should be continued. Many homemakers presently use only an empty peanut butter jar with the measurements identified on the jar. Home economists, dietitians, gourmets, and avid cooks may be able to buy a scale to weigh foods, but the average homemaker will not have as the highest priority the purchase of an expensive scale (or the economic means to do so).

Therefore, the following guidelines are recommended by the writer:

1) Americans continue to cook using volume measures delineated with the following commonly used units: litre and millilitre. Terms not recommended for volume measures: dekalitre, decilitre, centilitre, and fractions of litres.

Examples:	CORRECT	INCORRECT
	500 millilitres or 0.5 litre	1/2 litre or 5/10 litre
	200 millilitres or 0.2 litre	2 decilitres

2) In recipes calling for food ingredients by mass (or weight) (i.e., meat, bulk produce), the commonly used units are gram and kilogram. Terms not recommended for use are: dekagram and centigram. Milligrams are already in common usage designating the nutrient content of food.

. . . the Editor

REFERENCE: MEASURING VOLUME

More and more involvement in metrics related to the consumer indicate the direction for measuring food items will be by volume rather than by weight. Items to be measured by weight would be meat products, bulk staple items, and other grocery items normally purchased now by the pound. Recipe items measured in volume will use the approximate measures listed here:

OUNCES	STANDARD UNIT	MILLILITRES	LITRES
	1/8 tsp	.5	.000 5
	1/4 tsp	1	.001
	1/2 tsp	2.5	.002 5
	1 tsp	5	.005
	2 tsp	10	.01
1/2 oz	(3 tsp) 1 T	15	.015
1 oz	2 T	30	.03
2 oz	1/4 cup	60	
3 oz		90	
4 oz	1/2 cup	120	
5 oz		150	
6 oz	3/4 cup	180	
7 oz		210	
8 oz	1 cup	240	.24
9 oz		270	
10 oz	3/4 cup	300	.3
11 oz		330	
12 oz	1 1/2 cup	360	
13 oz		390	
14 oz	1 3/4 cup	420	
15 oz		450	
16 oz	(2 cups) 1 pint	480	.48
32 oz	(2 pints) (4 cups) 1 quart	960	.96
128 oz	(4 quarts) 1 gallon	3 840	3.84

CAUTION!

It is your professional responsibility as a home economist to use this chart ONLY as a guide. Be sure to test each recipe at least three times and modify as necessary before putting into print. (A good class project!)

REFERENCE: THE 1976 CHEVETTE - THE FIRST U. S. BUILT METRIC CAR

Specifications

Engine Displacement	1.4 litres
Mass	913 kilograms
Wheel Base	2 394 millimetres
Overall Length	4 031 millimetres
Height	1 329 millimetres
Width	1 570 millimetres
Windshield Area	0.7 square metres
Cargo Volume	742 litres
Fuel Tank Capacity	50 litres
Cooling System Capacity	8 litres
Recommended Tire Pressure	165 kilopascals

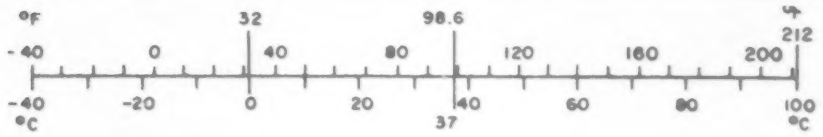
The Engineering Staff Metric Planning Activity has the assignment of developing metric conversion plans for the Corporation. Under these plans all new parts are being designed and manufactured to metric specifications.

REFERENCE: CONVERSION FACTORS

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



*1 in = 2.54 cm (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10: 286.

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F

This Letter Circular (LC1051) provides conversion factors for going from the more common customary units to metric units and vice versa. It may be reproduced freely. LC1051 is based on NBS Special Publication 365 (Revised Nov. 1972), "Metric Conversion Card", available by purchase as a wallet-size plasticized card from the U.S. Government Printing Office, Superintendent of Documents, Washington, D.C. 20402. Price 20 cents domestic postpaid, or 10 cents GPO Bookstore. Stock Number 0303–0168. Catalog No. C13.10: 365/2. (25 percent discount on orders of 100 or more copies).

REFERENCE:

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Washington, D.C. 20234

Letter Circular 1052
February 1974

All You Will Need to Know About Metric

(For Your Everyday Life)

10

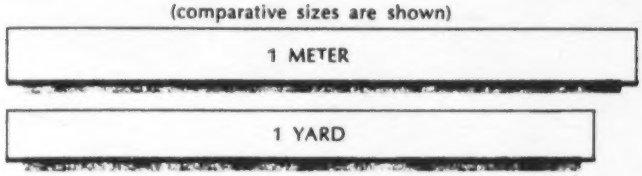
Metric is based on Decimal system

The metric system is simple to learn. For use in your everyday life you will need to learn only ten new units. You will also need to get used to a few new temperatures. There are even some metric units with which you are already familiar: those for time and electricity are the same as you use now.

BASIC UNITS

METER: a little longer than a yard (about 1.1 yards)
LITER: a little larger than a quart (about 1.06 quarts)
GRAM: a little more than the weight of a paper clip

(comparative sizes are shown)



25 DEGREES FAHRENHEIT

25 DEGREES CELSIUS

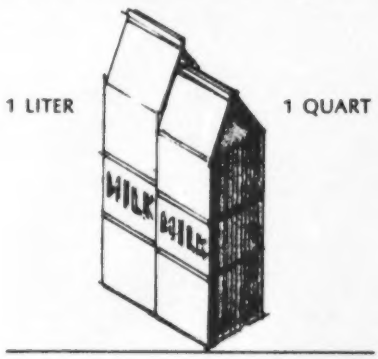
COMMON PREFIXES

(to be used with basic units)

milli:	one-thousandth (0.001)
centi:	one-hundredth (0.01)
kilo:	one-thousand times (1000)

For example:

1000 millimeters = 1 meter
100 centimeters = 1 meter
1000 meters = 1 kilometer

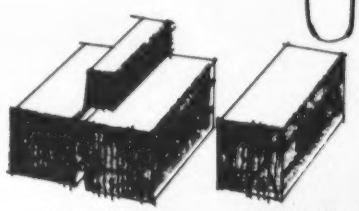


OTHER COMMONLY USED UNITS

millimeter:	0.001 meter	diameter of paper clip wire
centimeter.	0.01 meter	a little more than the width of a paper clip (about 0.4 inch)
kilometer:	1000 meters	somewhat further than ½ mile (about 0.6 mile)
kilogram:	1000 grams	a little more than 2 pounds (about 2.2 pounds)
milliliter:	0.001 liter	five of them make a teaspoon

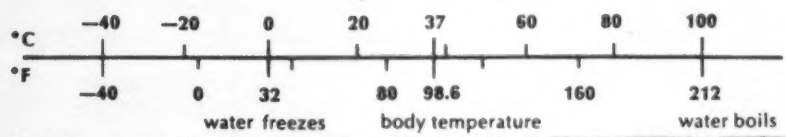
OTHER USEFUL UNITS

hectare: about 2½ acres
tonne: about one ton



TEMPERATURE

degrees Celsius are used



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REFERENCE: CLOTHING SIZES

A great deal of confusing information exists regarding clothing sizes and the metric system. As yet, there is no system of "metric sizes" for women, men, or children. An assumption has been made by many Americans that the European countries use a "metric size system." Upon closer inspection, it is found that Finland, Sweden, France, Switzerland, Austria, Denmark, and the United Kingdom each have their own variation of garment sizes and identify the sizes in a differing manner. Because of this confusion, the American garment industry hesitates to change to one of the European systems...and understandably so! The American garment industry, however, is ready to go metric. For years pattern companies have been printing international catalogues with the body measurements in centimetres and the fabric amounts in metres. The sizes will remain as they are now until a true international garment sizing system is developed.

An attempt to standardize shoe sizes in South Africa resulted in development of the MONDOPOINT SYSTEM. The following quote is from "Metrication for the Family," a publication of the South African Bureau of Standards:

> In South Africa, footwear was imported from countries using four different sizing systems. To overcome so much confusion the MONDOPOINT SYSTEM was developed. The shoe size comprises two numbers, the size and the width index. The size is obtained by measuring the actual length of the foot in millimetres while the person is standing on that foot. The width index indicates the fitting. Once the Mondopoint System is in use, it will make no difference where you buy your shoes... in Johannesburg, Paris, or London...the size will remain the same.

. . . the Editor

QUICK CONVERSION GUIDE:	
1 millimetre (mm)	= 0.04 inch
1 metre (m)	= 3.3 feet
1 metre (m)	= 1.1 yards
1 kilometre (km)	= 0.6 miles
1 litre (l)	= 1.05 quarts
1 kilogram (kg)	= 2.2 pounds

Prepared by Orange County Department of Education, Carole Bielefeld, Coordinator, Home Economics, for Metric Workshop, U.C.L.A. Ext., Sept. 7-8, 1973.

PREFIXES/BASE UNITS

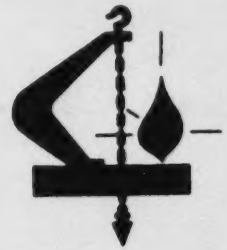
Kilo-	x 1 000
Hecto	x 100

Units: metre, litre, gram

Deci-	1/10
Centi-	1/100
Milli-	1/1 000

fold

Example:
Kilometre = 1 000 metres
metre = basic unit
Millimetre = 1/1 000



CALIFORNIA HOME ECONOMICS ASSOCIATION

64

PERSONAL METRIC MEASUREMENTS

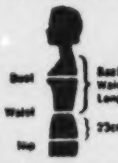
FOR _____ Weight _____ kg Height _____ cm

GARMENT & PATTERN SIZES*		8	10	12	14	16	18	YOUR MEASUREMENTS
STANDARD	Bust	80	83	86	92	97	102 cm	_____ cm
BODY	Waist	58	61	65	69	74	79 cm	_____ cm
MEASUREMENTS	Hip - 23 cm below waist	85	88	91	97	102	107 cm	_____ cm
	Back - neck to waist	40	40.5	41	42	42.5	43 cm	_____ cm

*Metric measurements are based on the Standardized Pattern Measurement Chart approved by the Measurement Standard Committee of the Pattern Fashion Industry.

REFERENCE: PATTERN SIZING

1,65m to 1,68m



MISSES'

Misses' patterns are designed for a well proportioned, and developed figure; about 1,65m to 1,68m without shoes.

Size	6	8	10	12	14	16	18	20	
Bust	78	80	83	87	92	97	102	107	cm
Waist	58	61	64	67	71	76	81	87	cm
Hip	83	85	88	92	97	102	107	112	cm
Back Waist Length	39,5	40	40,5	41,5	42	42,5	43	44	cm

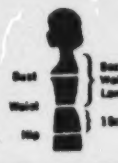
1,63m to 1,65m

JUNIOR

Junior patterns are designed for a well proportioned shorter waisted figure, about 1,63m to 1,65m without shoes.

Size	5	7	9	11	13	15	
Bust	76	79	81	85	89	94	cm
Waist	57	60	62	65	69	74	cm
Hip	81	84	87	90	94	99	cm
Back Waist Length	38	39	39,5	40	40,5	41,5	cm

1,57m to 1,60m



MISS PETITE

This new size range is designed for the shorter Miss figure, about 1,57m to 1,60m without shoes.

Size	8mp	8mp	10mp	12mp	14mp	16mp	
Bust	78	80	83	87	92	97	cm
Waist	60	62	65	69	73	78	cm
Hip	83	85	88	92	97	102	cm
Back Waist Length	37	37,5	38	39	39,5	40	cm

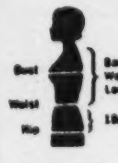
1,52m to 1,55m

JUNIOR PETITE

Junior Petite patterns are designed for a well proportioned petite figure, about 1,52m to 1,55m without shoes.

Size	3jp	5jp	7jp	9jp	11jp	13jp	
Bust	78	79	81	84	87	89	cm
Waist	57	58	61	64	66	69	cm
Hip	80	81	84	87	89	92	cm
Back Waist Length	35,5	36	37	37,5	38	39	cm

1,57m to 1,60m

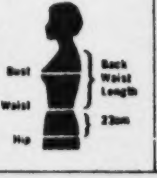


HALF-SIZE

Half-size patterns are for a fully developed figure with a short backwaist length. Waist and hip are larger in proportion to bust than other figure types; about 1,57m to 1,60m without shoes.

Size	10½	12½	14½	16½	18½	20½	22½	24½	
Bust	84	89	94	99	104	109	114	119	cm
Waist	69	74	79	84	89	96	102	108	cm
Hip	89	94	99	104	109	116	122	128	cm
Back Waist Length	38	39	39,5	40	40,5	40,5	41	41,5	cm

1,65m to 1,68m

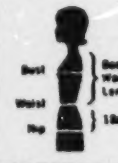


WOMEN'S

Women's patterns are designed for the larger, more fully mature figure: about 1,65m to 1,68m without shoes.

Size	38	40	42	44	46	48	50	
Bust	107	112	117	122	127	132	137	cm
Waist	89	94	99	105	112	118	124	cm
Hip	112	117	122	127	132	137	142	cm
Back Waist Length	44	44	44,5	45	45	45,5	46	cm

1,55m to 1,60m



YOUNG JUNIOR/TEEN

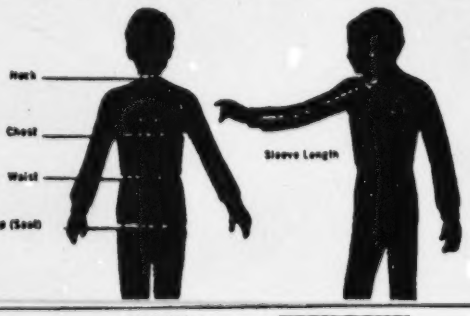
This new size range is designed for the developing pre-teen and teen figures, about 1,55m to 1,60m without shoes.

Size	5/6	7/8	9/10	11/12	13/14	15/16	
Bust	71	74	78	81	85	89	cm
Waist	56	58	61	64	66	69	cm
Hip	79	81	85	89	93	97	cm
Back Waist Length	34,5	35,5	37	38	39	40	cm

GIRLS'

Girls patterns are designed for the girl who has not yet begun to mature. See chart below for approximate heights without shoes.

Size	7	8	10	12	14	
Breast	66	69	73	76	81	cm
Waist	58	60	62	65	67	cm
Hip	69	71	76	81	87	cm
Back Waist Length	29,5	31	32,5	34,5	36	cm
Approx. Height	127	132	142	149	155	cm



CHUBBIE

Chubbie patterns are designed for the growing girl who is over the average weight for her age and height. See below for approximate height, with shoes.

Size	8½s	10½s	12½s	14½s	
Breast	76	80	84	88	cm
Waist	71	74	76	79	cm
Hip	84	88	92	96	cm
Back Waist Length	31	32,5	34,5	36	cm
Approx. Height	132	142	149	155	cm

	BOYS'			TEEN-BOYS'					
Size	7	8	10	12	14	16	18	20	
Chest	66	69	71	76	81	85	89	93	cm
Waist	58	61	64	66	69	71	74	76	cm
Hip (Seat)	69	71	75	79	83	87	90	94	cm
Neckband	30	31	32	33	34,5	35,5	37	38	cm
Height	122	127	137	147	155	163	168	173	cm

CHILDREN'S MEASUREMENTS

Measure around the breast, but not too snugly. Toddler patterns are designed for a figure between that of a baby and a child. Toddler's dresses are shorter than the similar child's dress and toddler's pants have a diaper allowance.

TODDLERS'

Size	1/2	1	2	3	4	
Breast or Chest	48	51	53	56	58	cm
Waist	48	50	51	52	53	cm
Finished Dress Length	35,5	38	40,5	43	46	cm

	MEN'S (height approximately 178 cms)							
Size	34	36	38	40	42	44	46	48	
Chest	87	92	97	102	107	112	117	122	cm
Waist	71	76	81	87	92	99	107	112	cm
Hip (Seat)	89	94	99	104	109	114	119	124	cm
Neckband	35,5	37	38	39,5	40,5	42	43	44,5	cm
Shirt Sleeve	81	81	84	84	87	87	89	89	cm

CHILDREN'S

Size	1	2	3	4	5	6	6x	
Breast or Chest	51	53	56	58	61	64	65	cm
Waist	50	51	52	53	55	56	57	cm
Hip				61	64	66	67	cm
Back Waist Length	21	22	23	24	25,5	27	27,5	cm
Height	79	87	94	102	109	117	122	cm
Finished Dress Length	43	46	48	51	56	61	64	cm

REFERENCE CHART NECESSARY FOR STATION "GREEN"

METRIC CHART
CONVERTING INCHES AND YARDS TO CENTIMETRES AND METRES

Extra fabric is needed to match plaids, stripes, one-way designs. SIMPLICITY 5574

STANDARD BODY MEASUREMENTS	Bust	83	86	92	97	102	cm
	Waist	61	65	69	74	79	cm
	Hip - 23 cm below waist	88	91	97	102	107	cm
	Back-neck to waist	40.5	41	42	42.5	43	cm
Fabric required	Sizes	10	12	14	16	18	
Front Wrap-Top							
90 cm without nap		2.90	2.90	2.90	2.90	3.00	m
115 cm " "		2.10	2.40	2.55	2.65	2.75	m
140 cm " "		1.50	1.60	1.85	1.95	2.20	m
150 cm " "		1.40	1.50	1.60	1.75	1.85	m
Pants							
115 cm, 140 cm without nap		2.40	2.40	2.40	2.40	2.55	m
150 cm without nap		2.10	2.20	2.40	2.40	2.55	m
Elastic - 2 cm wide		0.70	0.80	0.80	0.95	0.95	m
Garment Measurements							
Finished back length of front-wrap top		57.8	58.4	59	59.7	61	cm
Finished length at side seam from waistline marking of pants		104.1	104.7	105.3	105.9	106.7	cm
Bottom width of pants leg		87	89.5	92.7	95.8	99	cm

Sewing notions: Thread, seam binding or stretch lace.

REFERENCE: LENGTH OF ZIPPER -- CONVERSION CHART

Inch	Centimetre	Inch	Centimetre
4	10	20	50
6	15	22	55
8	20	24	60
10	25	26	65
12	30	28	70
14	35	30	75
16	40	32	80
18	45		

REFERENCE: FABRIC LENGTH -- CONVERSION CHART

Yard	Metre	Yard	Metre
1/8	0.1	1	0.9
1/4	0.2	2	1.8
3/8	0.3	3	2.8
1/2	0.5	4	3.7
2/3	0.6	5	4.6
3/4	0.7	6	5.5
7/8	0.8	7	6.4
		8	7.4
		9	8.3
		10	9.2

These equivalents are only approximate.
Remember: 0.1 m = 10 cm
0.2 m = 20 cm, etc.

REFERENCE: COMMON HOUSEHOLD MEASURES (CONVERSIONS)

1 teaspoon = 5 millilitres (ml)
1 tablespoon = 15 ml
1 cup = 250 ml (approx.)
1 pound of meat (plus a little more) = 0.5 kilogram (kg) or 500 grams (g)
2 pounds of meat (plus a little more) = 1 kg
1 ounce = approximately 30 g
1 quart (plus a little more) = 1 litre (l)

* * *

REFERENCE: MEASURING COMMON FOOD PRODUCTS

Measure the following foods by the gram or kilogram:

Onions
Potatoes
Apples
Margarine
Coffee

Measure the following foods by the litre:

Milk
Water
Oil

* * *

REFERENCE: OVEN TEMPERATURES

Suggestion: Duplicate this chart, cover with plastic, and attach to your oven or cooking area.

Oven Temperatures	°F	°C
Very slow	250 - 275	120 - 135
Slow	300 - 325	150 - 165
Moderate	350 - 375	175 - 190
Hot	400 - 425	205 - 220
Very hot	450 - 475	230 - 245

REFERENCE: BAKING UTENSILS -- STANDARD SIZES IN U.S. CUSTOMARY UNITS AND IN ROUNDED METRIC UNITS

Utensil	U.S. Customary Units	Metric Units, Rounded
Cake Pans:		
Oblong	13" x 9" x 2"	33 cm x 23 cm x 5 cm
Round	8" round	20 cm round
	9" round	23 cm round
	10" round	25 cm round
Square	8" square	20 cm square
	9" square	23 cm square
	10" square	25 cm square
Tube (Angel)	9"	23 cm
	10"	25 cm
Pie Pans:	6"	15 cm
	8"	20 cm
	9"	23 cm
	10"	25 cm
Cookie Sheet:	14" x 10"	36 cm x 25 cm
Jelly Roll Pan:	15½" x 10½" x 1"	39 cm x 25 cm x 3 cm
Loaf Pan:	9" x 5" x 3"	23 cm x 13 cm x 8 cm

SOURCE OF METRIC SUPPLIES

Dick Blick Company, P. O. Box 1267, Galesburg, Illinois 61401
Telephone: (309) 343-6181. Send for their colorful catalogue.
Here are some of their items which are designed for consumer use:

100 cm coated linen tape measure (#88010)	$ 2.60/set of 10
Sturdy 1 kg scale divided into 5 gram increments (#88117)	$14.80 each
Sturdy 5 kg scale divided into 25 gram increments (#88116)	$14.90 each
Celsius cooking thermometer from 20 °C to 260 °C (#88124)	$14.50 each
A clear plastic litre cube graduated in 100 ml divisions (#88134)	$ 2.60 each
Measuring beaker set for consumer use; sizes of 2 litre, 1 litre, 500 ml, and 250 ml (#88137)	$ 7.40/set of 4

Kitchen measuring utensils have been found in limited quantities from various local gourmet shops, import stores, and European-geared stores such as: Karen Margreta's in Corona del Mar, Alpine Village in Torrance, Old Town in Torrance, various health food stores, and hospital suppliers.

THINK METRIC bath scales are available from Regal-Beloit Corporation, Rockton Road, P. O. Box 38, South Beloit, Illinois, for about $15.

Cal Western Supply Company, 126 East Graham Place, Burbank, CA 91502, handles metric and industrial hardware, tools and gauges. They are also a local distributor of THINK METRIC bathroom scales and metre sticks. Call (213) 849-6711 to place an order.

Handy "Cook 'n Sew English Metric Converter" is available for $2.50 from Union Carbide Corporation, Educational Aids Department, P. O. Box 363, Tuxedo, New York 10987.

Handy Metric Conversion Chart, 25 cents each from Bennett Books Company, 908 West Detweiller Drive, Peoria, Illinois 61614.

The following list of metric aids are available from Metric Association, Inc., Sugarloaf Star Route, Boulder, Colorado 80302.

20 cm white plastic ruler: 10 or more 10 cents each
1.5 m flexible plastic measuring tape: 5 or more 40 cents each
50 or more 30 cents each

Metric Units of Measure, pamphlet, 10 or more 10 cents each
Metric Handbook for Hospitals, booklet: 5 or more 40 cents each
50 or more 30 cents each
Metric Conversion Card: 10 cents each

Minimum order is $1.00. Prices include shipping.

Foley's plastic "multi-measure" is a volume measuring utensil marked in three systems: cups and fractions thereof, fluid ounces, and millilitres. The cost is 80 cents each plus 25% handling charges.
Write: Foley Manufacturing Company, 3300 N.E. Fifth Street, Minneapolis, Minnesota 55418. (Request #215 Multi-Measure)
The multi-measure is also available at Save-On Drug Stores and other discount stores.

A free packet of materials for teachers and students is available upon request from Metric Information Office, National Bureau of Standards, Washington, D. C. 20234.

OHAUS Metric Teaching Aids, 29 Hanover Road, Florham Park, New Jersey 07932.
Catalogue available.
Metric Spoon Set, red plastic, ringed 5-piece set includes 1, 2, 5, 15 and 25 ml spoons at 75 cents per set (#80350).
Dry Measure Set, red plastic, for larger volume measures, ringed set includes 50, 125 and 250 ml measures at $1.50 per set (#80340).

AIDS FOR THE AGE OF METRIC

ORDER	NO.	DESCRIPTION		MASS	(WEIGHT)	PRICE
_____	5345	4 Pc. Metric Weights (Mass Pieces) 100 g 50 g 25 g 25 g	Set	225 g	8 oz.	$7.00
_____	5346	Single Beam Balance Scale With No. 5349 Metric Weights (Mass Pieces)	Each	1.35 kg	3 lbs.	18.50
_____	5349	8 Pc. Metric Weights (Mass Pieces)—50 g 20 g 10 g 10 g 5 g 2 g 2 g 1 g	Set	113 g	4 oz.	3.00
_____	5416	Celsius Laboratory Thermometer	Each	85 g	3 oz.	2.75
_____	5556	Celsius Student Thermometers	Pkg. of 10	85 g	3 oz.	4.00
_____	7030	Meter Stick	Each	113 g	4 oz.	.75
_____		Meter Sticks	Pkg. of 10	907 g	2 lbs.	5.00
_____	7031	Demonstration Meter Stick	Each	227 g	8 oz.	2.25
_____	7034	20 cm Student Rulers (Plastic)	Pkg. of 10	142 g	5 oz.	2.00
_____	7036	1.5 m Measuring Tape	Each	28 g	1 oz.	.50
_____		1.5 m Measuring Tapes	Pkg. of 20	454 g	1 lb.	9.00
_____	7045	Metric Volume Set – Plastic 1 each 1000 ml 250 ml 100 ml 50 ml 10 ml	Set	336 g	12 oz.	7.00
_____	7055	*Publication – Metric Units Of Measure	Each	14 g	1/2 oz.	.40
_____		Metric Units Of Measure	Pkg. of 10	224 g	8 oz.	3.50
_____	7056	*Publication – Metric Supplement to Science and Math	Each	71 g	2½ oz.	1.25
_____		Metric Supplement to Science and Math	Pkg. of 10	710 g	1½ lbs.	7.50
_____	7057	*Publication – Metric Handbook for Hospitals	Each	28 g	1 oz.	.50
_____		Metric Handbook for Hospitals	Pkg. of 10	113 g	4 oz.	4.50
_____	7058	"Go Metric" Lapel Pins	Pkg. of 10	113 g	4 oz.	5.00
_____	7059	"Go Metric" Bumper Stickers	Pkg. of 10	170 g	6 oz.	1.50
_____	7566	Place Value Building Set	Set	3.4 kg	7½ lbs.	39.75
_____	7777	Metric Place Value Chart	Each	567 g	1¼ lbs.	2.80
_____	7039	Metric Wall Chart in color	Each			2.50

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METRIC CONVERSION ACT OF 1975

Public Law 94-168
94th Congress, H. R. 8674
December 23, 1975

An Act

To declare a national policy of coordinating the increasing use of the metric system in the United States, and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Metric Conversion Act of 1975".

Metric Conversion Act of 1975, 15 USC 205a note, 15 USC 205a.

SEC. 2. The Congress finds as follows:

(1) The United States was an original signatory party to the 1875 Treaty of the Meter (20 Stat. 709), which established the General Conference of Weights and Measures, the International Committee of Weights and Measures and the International Bureau of Weights and Measures.

(2) Although the use of metric measurement standards in the United States has been authorized by law since 1866 (Act of July 28, 1866; 14 Stat. 339), this Nation today is the only industrially developed nation which has not established a national policy of committing itself and taking steps to facilitate conversion to the metric system.

15 USC 205b.

SEC. 3. It is therefore declared that the policy of the United States shall be to coordinate and plan the increasing use of the metric system in the United States and to establish a United States Metric Board to coordinate the voluntary conversion to the metric system.

Definitions, 15 USC 205c.

SEC. 4. As used in this Act, the term—

(1) "Board" means the United States Metric Board, established under section 5 of this Act;

(2) "engineering standard" means a standard which prescribes (A) a concise set of conditions and requirements that must be satisfied by a material, product, process, procedure, convention, or test method; and (B) the physical, functional, performance and/or conformance characteristics thereof;

(3) "international standard or recommendation" means an engineering standard or recommendation which is (A) formulated and promulgated by an international organization and (B) recommended for adoption by individual nations as a national standard; and

(4) "metric system of measurement" means the International System of Units as established by the General Conference of Weights and Measures in 1960 and as interpreted or modified for the United States by the Secretary of Commerce.

United States Metric Board, Establishment, 15 USC 205d.

SEC. 5. (a) There is established, in accordance with this section, an independent instrumentality to be known as a United States Metric Board.

Membership.

(b) The Board shall consist of 17 individuals, as follows:

(1) the Chairman, a qualified individual who shall be appointed by the President, by and with the advice and consent of the Senate;

(2) sixteen members who shall be appointed by the President, by and with the advice and consent of the Senate, on the following basis—

(A) one to be selected from lists of qualified individuals recommended by engineers and organizations representative of engineering interests;

(B) one to be selected from lists of qualified individuals recommended by scientists, the scientific and technical community, and organizations representative of scientists and technicians;

(C) one to be selected from a list of qualified individuals recommended by the National Association of Manufacturers or its successor;

(D) one to be selected from lists of qualified individuals recommended by the United States Chamber of Commerce, or its successor, retailers, and other commercial organizations;

(E) two to be selected from lists of qualified individuals recommended by the American Federation of Labor and Congress of Industrial organizations or its successor, who are representative of workers directly affected by metric conversion, and by other organizations representing labor;

(F) one to be selected from a list of qualified individuals recommended by the National Governors Conference, the National Council of State Legislatures, and organizations representative of State and local government;

(G) two to be selected from lists of qualified individuals recommended by organizations representative of small business;

(H) one to be selected from lists of qualified individuals representative of the construction industry;

(I) one to be selected from a list of qualified individuals recommended by the National Conference on Weights and Measures and standards making organizations;

(J) one to be selected from lists of qualified individuals recommended by educators, the educational community, and organizations representative of educational interests; and

(K) four at-large members to represent consumers and other interests deemed suitable by the President and who shall be qualified individuals.

Term of office.

As used in this subsection, each "list" shall include the names of at least three individuals for each applicable vacancy. The terms of office of the members of the Board first taking office shall expire as designated by the President at the time of nomination; five at the end of the 2d year; five at the end of the 4th year; and six at the end of the 6th year. The term of office of the Chairman of such Board shall be 6 years. Members, including the Chairman, may be appointed to an additional term of 6 years, in the same manner as the original appointment. Successors to members of such Board shall be appointed in the same manner as the original members and shall have terms of office expiring 6 years from the date of expiration of the terms for which their predecessors were appointed. Any individual appointed to fill a vacancy occurring prior to the expiration of any term of office shall be appointed for the remainder of that term. Beginning 45 days after the date of incorporation of the Board, six members of such Board shall constitute a quorum for the transaction of any function of the Board.

Quorum.

(c) Unless otherwise provided by the Congress, the Board shall have no compulsory powers.

(d) The Board shall cease to exist when the Congress, by law, determines that its mission has been accomplished.

Policy implementation. 15 USC 205e.

SEC. 6. It shall be the function of the Board to devise and carry out a broad program of planning, coordination, and public education, con-

sistent with other national policy and interests, with the aim of implementing the policy set forth in this Act. In carrying out this program, the Board shall—

(1) consult with and take into account the interests, views, and conversion costs of United States commerce and industry, including small business; science; engineering; labor; education; consumers; government agencies at the Federal, State, and local level; nationally recognized standards developing and coordinating organizations; metric conversion planning and coordinating groups; and such other individuals or groups as are considered appropriate by the Board to the carrying out of the purposes of this Act. The Board shall take into account activities underway in the private and public sectors, so as not to duplicate unnecessarily such activities;

(2) provide for appropriate procedures whereby various groups, under the auspices of the Board, may formulate, and recommend or suggest, to the Board specific programs for coordinating conversion in each industry and segment thereof and specific dimensions and configurations in the metric system and in other measurements for general use. Such programs, dimensions, and configurations shall be consistent with (A) the needs, interests, and capabilities of manufacturers (large and small), suppliers, labor, consumers, educators, and other interested groups, and (B) the national interest;

Comments and hearings.

(3) publicize, in an appropriate manner, proposed programs and provide an opportunity for interested groups or individuals to submit comments on such programs. At the request of interested parties, the Board, in its discretion, may hold hearings with regard to such programs. Such comments and hearings may be considered by the Board;

(4) encourage activities of standardization organizations to develop or revise, as rapidly as practicable, engineering standards on a metric measurement basis, and to take advantage of opportunities to promote (A) rationalization or simplification of relationships, (B) improvements of design, (C) reduction of size variations, (D) increases in economy, and (E) where feasible, the efficient use of energy and the conservation of natural resources;

(5) encourage the retention, in new metric language standards, of those United States engineering designs, practices, and conventions that are internationally accepted or that embody superior technology;

Consultation and cooperation.

(6) consult and cooperate with foreign governments, and intergovernmental organizations, in collaboration with the Department of State, and, through appropriate member bodies, with private international organizations, which are or become concerned with the encouragement and coordination of increased use of metric measurement units or engineering standards based on such units, or both. Such consultation shall include efforts, where appropriate, to gain international recognition for metric standards proposed by the United States, and, during the United States conversion, to encourage retention of equivalent customary units, usually by way of dual dimensions, in international standards or recommendations;

Public information and education programs.

(7) assist the public through information and education programs, to become familiar with the meaning and applicability of metric terms and measures in daily life. Such programs shall include—

(A) public information programs conducted by the Board, through the use of newspapers, magazines, radio, television, and other media, and through talks before appropriate citizens' groups, and trade and public organizations;

(B) counseling and consultation by the Secretary of Health, Education, and Welfare; the Secretary of Labor; the Administrator of the Small Business Administration; and the Director of the National Science Foundation, with educational associations, State and local educational agencies, labor education committees, apprentice training committees, and other interested groups, in order to assure (i) that the metric system of measurement is included in the curriculum of the Nation's educational institutions, and (ii) that teachers and other appropriate personnel are properly trained to teach the metric system of measurement;

(C) consultation by the Secretary of Commerce with the National Conference of Weights and Measures in order to assure that State and local weights and measures officials are (i) appropriately involved in metric conversion activities and (ii) assisted in their efforts to bring about timely amendments to weights and measures laws; and

(D) such other public information activities, by any Federal agency in support of this Act, as relate to the mission of such agency;

(8) collect, analyze, and publish information about the extent of usage of metric measurements; evaluate the costs and benefits of metric usage; and make efforts to minimize any adverse effects resulting from increasing metric usage;

Surveys. Recommendations to Congress and President.

(9) conduct research, including appropriate surveys; publish the results of such research; and recommend to the Congress and to the President such action as may be appropriate to deal with any unresolved problems, issues, and questions associated with metric conversion, or usage. such problems, issues, and questions may include, but are not limited to, the impact on workers (such as costs of tools and training) and on different occupations and industries, possible increased costs to consumers, the impact on society and the economy, effects on small business, the impact on the international trade position of the United States, the appropriateness of and methods for using procurement by the Federal Government as a means to effect conversion to the metric system, the proper conversion or transition period in particular sectors of society, and consequences for national defense;

Report to Congress and President.

(10) submit annually to the Congress and to the President a report on its activities. Each such report shall include a status report on the conversion process as well as projections for the conversion process. Such report may include recommendations covering any legislation or executive action needed to implement the the programs of conversion accepted by the Board. The Board may also submit such other reports and recommendations as it deems necessary; and

Report to Congress and President.

(11) submit to the Congress and to the President, not later than 1 year after the date of enactment of the Act making appropriations for carrying out this Act, a report on the need to provide an effective structural mechanism for converting customary units to metric units in statutes, regulations, and other laws at all levels of government, on a coordinated and timely basis, in response to voluntary conversion programs adopted and implemented by various sectors of society under the auspices and with the approval

of the Board. If the Board determines that such a need exists, such report shall include recommendations as to appropriate and effective means for establishing and implementing such a mechanism.

SEC. 7. In carrying out its duties under this Act, the Board may—

Committees, establishment. 15 USC 205f.

(1) establish an Executive Committee, and such other committees as it deems desirable;

(2) establish such committees and advisory panels as it deems necessary to work with the various sectors of the Nation's economy and with Federal and State governmental agencies in the development and implementation of detailed conversion plans for those sectors. The Board may reimburse, to the extent authorized by law, the members of such committees;

Hearings.

(3) conduct hearings at such times and places as it deems appropriate;

Contracts.

(4) enter into contracts, in accordance with the Federal Property and Administrative Services Act of 1949, as amended (40 U.S.C. 471 et seq.), with Federal or State agencies, private firms, institutions, and individuals for the conduct of research or surveys, the preparation of reports, and other activities necessary to the discharge of its duties;

(5) delegate to the Executive Director such authority as it deems advisable; and

(6) perform such other acts as may be necessary to carry out the duties prescribed by this Act.

Gifts and bequests. 15 USC 205g.

SEC. 8. (a) The Board may accept, hold, administer, and utilize gifts, donations, and bequests of property, both real and personal, and personal services, for the purpose of aiding or facilitating the work of the Board. Gifts and bequests of money, and the proceeds from the sale of any other property received as gifts or bequests, shall be deposited in the Treasury in a separate fund and shall be disbursed upon order of the Board.

(b) For purpose of Federal income, estate, and gift taxation, property accepted under subsection (a) of this section shall be considered as a gift or bequest to or for the use of the United States.

(c) Upon the request of the Board, the Secretary of the Treasury may invest and reinvest, in securities of the United States, any moneys contained in the fund authorized in subsection (a) of this section. Income accruing from such securities, and from any other property accepted to the credit of such fund, shall be disbursed upon the order of the Board.

Unexpended funds.

(d) Funds not expended by the Board as of the date when it ceases to exist, in accordance with section 5(d) of this Act, shall revert to the Treasury of the United States as of such date.

Compensation. 15 USC 205h.

SEC. 9. Members of the Board who are not in the regular full-time employ of the United States shall, while attending meetings or conferences of the Board or while otherwise engaged in the business of the Board, be entitled to receive compensation at a rate not to exceed the daily rate currently being paid grade 18 of the General Schedule (under section 5332 of title 5, United States Code), including travel-time. While so serving, on the business of the Board away from their homes or regular places of business, members of the Board may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code, for persons employed intermittently in the Government service. Payments under this section shall not render members of the Board employees or officials of the United States for any purpose. Members of the Board who are in the employ of the United States shall be entitled to travel expenses when traveling on the business of the Board.

5 USC 5332 note.

Travel expenses.

Executive Director, appointment. 15 USC 205i.

SEC. 10. (a) The Board shall appoint a qualified individual to serve as the Executive Director of the Board at the pleasure of the Board. The Executive Director, subject to the direction of the Board, shall be responsible to the Board and shall carry out the metric conversion program, pursuant to the provisions of this Act and the policies established by the Board.

(b) The Executive Director of the Board shall serve full time and be subject to the provisions of chapter 51 and subchapter III of chapter 53 of title 5, United States Code. The annual salary of the Executive Director shall not exceed level III of the Executive Schedule under section 5314 of such title.

5 USC 5101 et seq. 5 USC 5331.

(c) The Board may appoint and fix the compensation of such staff personnel as may be necessary to carry out the provisions of this Act in accordance with the provisions of chapter 51 and subchapter III of chapter 53 of title 5, United States Code.

Experts and consultants.

(d) The Board may (1) employ experts and consultants or organizations thereof, as authorized by section 3109 of title 5, United States Code; (2) compensate individuals so employed at rates not in excess of the rate currently being paid grade 18 of the General Schedule under section 5332 of such title, including traveltime; and (3) may allow such individuals, while away from their homes or regular places of business, travel expenses (including per diem in lieu of subsistence) as authorized by section 5703 of such title 5 for persons in the Government service employed intermittently: *Provided, however,* That contracts for such temporary employment may be renewed annually.

Financial and administrative services. 15 USC 205j.

SEC. 11. Financial and administrative services, including those related to budgeting, accounting, financial reporting, personnel, and procurement, and such other staff services as may be needed by the Board, may be obtained by the Board from the Secretary of Commerce or other appropriate sources in the Federal Government. Payment for such services shall be made by the Board, in advance or by reimbursement, from funds of the Board in such amounts as may be agreed upon by the Chairman of the Board and by the source of the services being rendered.

Appropriation authorization. 15 USC 205k.

SEC. 12. There are authorized to be appropriated such sums as may be necessary to carry out the provisions of this Act. Appropriations to carry out the provisions of this Act may remain available for obligation and expenditure for such period or periods as may be specified in the Acts making such appropriations.

Approved December 23, 1975.

LEGISLATIVE HISTORY:

HOUSE REPORT No. 94-369 (Comm. on Science and Technology).
SENATE REPORT No. 94-500 (Comm. on Commerce).
CONGRESSIONAL RECORD, Vol. 121 (1975):
Sept. 5, considered and passed House.
Dec. 8, considered and passed Senate, amended, in lieu of S. 100.
Dec. 11, House concurred in Senate amendment.
WEEKLY COMPILATION OF PRESIDENTIAL DOCUMENTS, Vol. 11, No. 52:
Dec. 23, Presidential statement.

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